Customer-specific synergies and market convergence

Schmidt, Jens ; Makadok, Richard ; Keil, Thomas

Abstract: We use an analytical model to study the effects of customer-specific synergies – i.e. synergies that arise when firms sell multiple products to the same customers. At the firm level, we show that the profitability of a customer-specific synergy depends upon cross-market correlation of customer preferences, differs when the synergy is cost-based versus differentiation-based, and can be negative even when the synergy is kept proprietary to a single firm. We also show that returns to imitating such a synergy may decline as it strengthens. At the industry level, we find that exploiting customer-specific synergies causes endogenous market convergence at a point that depends upon whether the synergy is cost-based or differentiation-based and whether it is imitated.

DOI: https://doi.org/10.1002/smj.2372

Originally published at:
Schmidt, Jens; Makadok, Richard; Keil, Thomas (2016). Customer-specific synergies and market convergence. Strategic Management Journal, 37(5):870-895.
DOI: https://doi.org/10.1002/smj.2372

CUSTOMER-SPECIFIC SYNERGIES AND MARKET CONVERGENCE

Jens Schmidt
Aalto University
Institute of Strategy, Dept. of Industrial Engineering and Management
P.O.Box 15500, FIN-00076 Aalto
E-mail: jens.schmidt@aalto.fi

Richard Makadok
Emory University
Goisueta School of Business
1300 Clifton Road, Atlanta, GA 30322
E-mail: richard.makadok@emory.edu

Thomas Keil
University of Zurich
Department of Business Administration, Chair in International Management
Seilergraben 53, CH-8001 Zurich
E-mail: thomas.keil@business.uzh.ch

Abstract

We use an analytical model to study the effects of customer-specific synergies – i.e. synergies that arise when firms sell multiple products to the same customers. At the firm level, we show that the profitability of a customer-specific synergy depends upon cross-market correlation of customer preferences, differs when the synergy is cost-based versus differentiation-based, and can be negative even when the synergy is kept proprietary to a single firm. We also show that returns to imitating such a synergy may decline as it strengthens. At the industry level, we find that exploiting customer-specific synergies causes endogenous market convergence at a point that depends upon whether the synergy is cost-based or differentiation-based and whether it is imitated.

Keywords: customer-specific synergies, competitive advantage, bundling strategy, market convergence, demand-based theory

INTRODUCTION

How firms exploit synergies across product markets has been extensively studied in the strategy literature. Starting with the seminal study by Rumelt (1974), much research in this domain has focused on examining how sharing resources across product markets allows firms to benefit from economies of scope (Panzar & Willig, 1981) in the form of either reduced costs or increased customers willingness to pay (WTP). In this shared-resource tradition, research has explored conditions under which firms diversify (e.g., Wernerfelt & Montgomery, 1988), performance implications of such diversification (e.g, Palich, Cardinal, & Miller, 2000), as well as industry-level outcomes of diversification, such as multi-market contact (e.g., Gimeno & Woo, 1999).

There is, however, a second, much less explored mechanism for creating synergies across product markets. Starting with Lemelin (1982), a small literature has argued that a firm may reap synergies by extending its scope in ways that better serve or exploit its existing customers. Such customer-specific synergies arise in two ways. First, firms may enjoy benefits from selling several products to the same customer, e.g., by exploiting superior knowledge about customer needs or by reducing customer acquisition costs (Akcura & Srinivasan, 2005; Chatain, 2011; Zander & Zander, 2005). Second, firms may also exploit situations where customers enjoy benefits from using several of the same supplier's products together, e.g., due to customers' familiarity with and knowledge about products (Cottrell & Nault, 2004; Nayyar, 1990, 1993), superior product integration (Stremersch & Tellis, 2002), increased customer productivity (Hinterhuber, 2002), or reduced shopping or search costs (Klemperer & Padilla, 1997). For example, Monsanto offers farmers superior weed control by selling both genetically-modified crop seeds and an herbicide that kills all plants other than those grown from Monsanto's proprietary seeds. Similarly, standardizing user interfaces for different productivity software products, such as spreadsheets and word processors, made them easier to use together and ultimately led to convergence of these formerly separate markets into a single market for office suites.

Thanks to abundant research on multi-product firms, we know much about the conditions under which firm performance will benefit from merely sharing resources across product markets, as well as the industry-level implications of such sharing, yet we know little about when *customer-specific* synergies arise, how they are exploited by firms, and how they affect firm performance and industry-level outcomes. Studies that examine customer-specific synergies point to their relative importance, indicating that they may even be larger and more significant than the mere cross-product sharing of resources (Cottrell & Nault, 2004; Nayyar, 1993). However, no general theory of customer-specific synergies has yet been developed to help predict their effects on firm-level or industry-level outcomes. Our paper is the first to systematically pursue such a theory.

Customer-specific synergies and their effects

Like ordinary resource-sharing synergies, customer-specific synergies can, and usually do, require the firm to exploit some common factor across products. However, unlike synergies that arise *purely* from resource sharing, customer-specific synergies are only effective when the firm serves the same customers across product markets, so their profitability depends upon the degree to which customers concentrate their purchases by buying multiple products from a single firm. We use a formal model to analyze the interaction between customers' decisions about whether or not to concentrate their purchases and firms' decisions about pricing and bundling their products, and about investing in creating synergies between their products. In our model, we examine both the cases where the synergies are in the form of reduced costs for the firm (cost-based) and where they raise customers' WTP by increasing the benefits they enjoy (differentiation-based). We also explicitly model the structure of customer preferences by varying the relative prevalence of customers who intrinsically prefer to buy several products from a single seller as opposed to purchasing from different firms – a factor that we call the *cross-market preference correlation*, which is specific to a particular combination of product markets, as opposed to the concept of synergies, which may be firm-specific, or the concept of customer preferences, which are specific to individual customers.

Our model sheds light on an important mechanism that drives both firm- and industry-level outcomes: A firm's decisions must strike a balance between (1) exploiting its market power over 'safe' customers who would buy multiple products from the firm even without any synergies and (2) inducing 'marginal' customers who are nearly indifferent between competing products in at least one market to concentrate their purchases on that firm. We show that how firms strike this balance depends critically on the structure of customer preferences – in particular, on the degree of cross-market preference correlation. When this correlation is low or negative, the goal of attracting marginal customers becomes relatively more important compared to the goal of exploiting safe customers. This shift can then dramatically increase rivalry between firms, and the magnitude of this increase depends on whether the synergies are cost-based or differentiation-based.

Overview of results and contributions

We derive three types of results about customer-specific synergies. First, we generate firm-level results when the customer-specific synergies are inimitable and non-substitutable – and therefore proprietary to one firm – in which case they constitute a competitive advantage. Here, we find that, counterintuitively, such a proprietary customer-specific synergy can lead to lower profitability than if the firm had no synergy. This 'backfiring' occurs due to increased price rivalry triggered by customer preference structure: When there is a high concentration of a particular type of marginal customers, firms compete so aggressively for them that the extra value that the synergy creates is sometimes overwhelmed by the price decrease, and the resulting total profitability is lower than if the firm had no synergy. We also find that the profitability of a customer-specific synergy that cannot be imitated or substituted by rivals depends upon the cross-market preference correlation, and differs according to whether the synergy is cost-based or differentiation-based.

Second, at the industry level, we find that strengthening customer-specific synergies beyond a certain level may alter the basis of competition and give rise to market convergence, i.e. a shift from competition between individual products to competition between product bundles, thereby integrating previously separate markets (Greenstein & Khanna, 1997). Market convergence thus arises endogenously when firms exploit customer-specific synergies. Our model also shows that such convergence causes a substantial decrease in rivalry, since customer-specific synergies motivate firms to compete most aggressively to attract marginal customers who would otherwise buy one product from each firm, while market convergence eliminates those 'split-purchase' customers. We show how the threshold synergy strength required for market convergence differs with the cross-market preference correlation and the type of synergy (cost-based vs. differentiation-based).

Third, we consider the strategic decision of a disadvantaged firm about whether to imitate the synergy of the initially advantaged firm. The disadvantaged firm's benefit from imitation is the difference between its profit when the synergy is imitated across firms and its profit when the advantaged firm's synergy remains proprietary. Specifically, we find that the market convergence threshold occurs at a different point when the synergy is imitated across firms than when it remains proprietary to the advantaged firm. So, imitation may induce markets either to converge or diverge, depending on the type of synergy. When imitation triggers market divergence, the resulting increased rivalry has a counterintuitive effect: The disadvantaged firm's benefit from imitating a synergy can, in this case, actually drop as the strength of that synergy increases.

Our results speak to several distinct literatures. First, we complement prior research on competitive advantage that has highlighted the moderating effect of product market characteristics, such as customer preference structure or the degree of rivalry, on the relationship between competitive advantage and performance (e.g., Costa, Cool, & Dierickx, 2013; Schmidt & Keil, 2013). An interesting result of our model in this respect is that, under certain circumstances, exploiting proprietary customer-specific synergies may in fact reduce performance for the advantaged firm. This 'backfiring' effect is similar to a result obtained by Costa, Cool, and Dierickx (2013) in a single-market context; however, in our model it arises as a result of increased rivalry that is induced by the structure of customer preferences. Another novel result is our finding that the benefit of imitating a rival's competitive advantage may decline as the strength of that advantage increases.

Second, we add to the literature on the scope-performance relationship by showing that the benefits of exploiting customer-specific synergies depend on how these synergies match market characteristics and customer preferences, and that exploiting customer-specific synergies is not a sufficient condition for reaping additional profits when entering new markets that share the same customers, due to potential 'backfiring.'

Third, we contribute to the literature on market structure, and in particular market convergence, which is both an under-researched topic (Benner & Tripsas, 2012) and a rapidly spreading phenomenon across many industries (examples include telecom and entertainment services, mobile phones and digital cameras, manufacturing and maintenance services, or accounting and business consulting), which is causing increasing overlap of offerings across previously disparate markets and competition often shifting to integrated products (Wirtz, 2001). Our results point to the role of customer-specific synergies in driving market convergence. We also find that such market convergence may occur regardless of whether the customer-specific synergy is proprietary to one competitor or shared across rivals, but the threshold level of synergy required for market convergence differs in these two cases, and also differs between cost-based and differentiation-based synergies.

Finally, our results contribute to the emerging literature on the role that demand-side factors play in affecting strategy-level outcomes. Strategy scholars are increasingly examining core strategy topics from the demand side in addition to the resource side (Priem, 2007; Priem, Li, & Carr, 2012). This demand-side research has examined how both individual customer preferences, such as diminishing marginal utility from performance improvements (Adner & Zemsky, 2006) and aggregate market characteristics, such as customer heterogeneity (Makadok & Ross, 2013), affect firm-level outcomes. We extend this demand-side research by showing how the distribution of customer preferences and marginal customers' decisions about whether or not to concentrate their purchases affect: (1) how competitive advantages translate into performance outcomes, (2) the incentives for firms to expand across product markets that share the same customers, and (3) when and how markets converge. In addition, we show that these three outcomes are also affected by whether synergies are cost-based or whether they affect the benefits experienced by customers.

UNDERSTANDING CUSTOMER-SPECIFIC SYNERGY

Customer-specific synergies have been called 'client-specific economies of scope' (Chatain, 2011; Chatain & Zemsky, 2007), 'economies of scope in consumption' (Cottrell & Nault, 2004) or 'demand-side synergy' (Ye, Priem, & Alshwer, 2012). Firms that exploit customer-specific synergies offer combinations of products that, when purchased, consumed, or used together by the same customer, either reduce the firm's costs of serving that customer or allow that customer to experience larger benefits and thus increase her WTP for the product combination. Because ordinary shared-resource synergies have received much more attention in extant research than customer-specific synergies, examples of the former abound in the strategy literature – e.g., Southwest Airlines as described by Porter (1996) or Honda as described by Prahalad and Hamel (1990).

Examples of firms exploiting customer-specific synergies, on the other hand, may be less familiar, but are important in many industries. Airbus increases WTP by designing aircraft in a way that maximizes airlines' flexibility to shift flight crew members to different routes. In particular, its "fly-by-wire" technology enables Airbus to use the same cockpit, with the same instruments, controls, procedures, and handling, across all ten of its aircraft models, from the small short-haul A318 to the giant long-haul A380, so that the same pilots can fly all of them with relatively little re-training. This superior cross-product compatibility is a customer-specific synergy, since its benefits are only experienced by those airlines that buy multiple different models of Airbus aircraft, usually for use on different types of routes. So far, this advantage has been impossible for competitor Boeing to match because most of its aircraft models were designed in an earlier era before fly-by-wire technology was possible. Likewise, Monsanto was originally an agricultural chemicals company until after commercializing its proprietary Roundup broad-spectrum herbicide, when Monsanto also began selling crop seeds to farmers (see Hinterhuber, 2002). The company developed a competence in genomics to genetically engineer eight species of proprietary "Roundup Ready" crop seeds for growing the only plants that are not killed by Roundup. Farmers who combine Roundup Ready crops with Roundup herbicide thus enjoy the benefits of a reduction in labor and fuel required for tillage, and practicing more environmentally-friendly farming because only one application of herbicide is needed. These benefits increase WTP, but only for those farmers who buy both herbicide and seeds from Monsanto – i.e., a customer-specific synergy.

A common feature of the Airbus and Monsanto examples is that the synergies were kept proprietary as a sustained competitive advantage over an extended period of time. By contrast, consider Apple, which also exploited customer-specific synergies across product markets via superior cross-product compatibility. Its iPod music player only took off after it introduced the iTunes Store, thereby creating a superior seamless integrated fusion of device and content (see Yoffie, 2012), enforced via its proprietary FairPlay digital rights management system. This synergy is customer-specific because its benefits are only enjoyed by customers who purchase both the device and the content from Apple. Apple later extended these synergies by entering other mobile markets, namely phone handsets and tablet computers. However, the customer-specific synergies enjoyed by Apple were later imitated by Google, Amazon, and Microsoft, who also offer mobile devices seamlessly connected to their own digital content stores selling music, videos, games, apps, books, periodicals, etc.

Thus far, our examples of customer-specific synergies have been differentiation-based, where customers enjoyed increased benefits that increased their WTP when buying multiple products from the same firm. By contrast, on the cost-based side, many product manufacturers, such as IBM, GE, and Honeywell, also offer a range of services to their installed base of customers. These extra services – e.g., installation, customization, performance optimization, and maintenance – not only exploit the existing customer relationship, thereby reducing customer acquisition cost for the service business, but also help reduce warranty costs and product-development costs, due to better understanding of each customer's needs (Davies, 2004; Oliva & Kallenberg, 2003). Such markets often converge when manufacturers sell combined product/service bundles by default.

Customer-specific synergies and cross-market preference correlation

A firm that expands its business based on purely customer-specific synergies would only benefit from entering new markets where it can sell to the same customers who buy its existing products while anticipating and influencing the purchasing behavior of those specific customers across markets. This is in stark contrast to a firm that expands based on a more general shared-resource logic, which would benefit from entering any product market where it can leverage an existing resource, regardless of whether the products in question are purchased by the same customer. So, a firm's willingness to invest in expanding its business on the basis of customer-specific synergies should depend upon whether and what type of benefits the firm and its customers may reap (e.g., lower cost of selling multiple products to the same customer, as in our examples of IBM or GE, or higher customer productivity, as in the Monsanto example) and, more fundamentally, whether the firm can even be in the set of preferred suppliers for the products over which it seeks to exploit synergies.

Since a customer-specific synergy only creates economic value when the same customer buys multiple products from a firm, the profitability of such a synergy depends, in part, on how many customers will do so. So, the proportion of customers in the market with an intrinsic propensity to buy multiple products from a single seller can affect the performance of a firm with a customer-specific synergy. This proportion of customers who intrinsically prefer "one-stop shopping" may, for a variety of reasons, differ systematically in different situations involving different markets and industries (Chatain, 2011). For example, customers may prefer to purchase product combinations from a single supplier when there are significant search costs, which is true in many service industries (Nayyar, 1993), or when there are no standardized interfaces for combining products from different firms (Matutes & Regibeau, 1988), or when customers have little knowledge about how to combine products and thus rely on sellers for advice on which products work together best and for performing the actual assembly (Spiller & Zelner, 1997). They may also prefer one-stop shopping in industries where all competitors offer customer-loyalty incentives (e.g., airline frequent-flyer programs). On the other hand, customers may be indifferent toward one-stop shopping when they are knowledgeable about combining different firms' products, or when well-established interfaces and standards help them to do so (Matutes & Regibeau, 1988; 1992). In some situations, customers may even prefer to buy different products from different firms, such as in those factor markets where businesses are most vulnerable to 'hold-up' problems from their suppliers, and therefore prefer to reduce suppliers' bargaining power by sourcing different inputs from different suppliers (Williamson, 1979). Likewise, there may be some consumer markets, perhaps in fashion or entertainment, where customers have an intrinsic preference for variety and change (McAlister, 1982).

The relative prevalence of customers who intrinsically prefer to buy multiple products from a single seller is captured by a factor we call *cross-market preference correlation*. It is higher in situations where a greater proportion of customers intrinsically prefers buying both products from the same firm. A positive correlation means that most customers intrinsically like one-stop shopping, while a negative correlation means that most customers intrinsically dislike one-stop shopping. Cross-market preference may change over the lifecycle of an industry – e.g., when customers learn how to combine products themselves and therefore depend less on firms to do that combining for them (Christensen, Verlinden, & Westerman, 2002). Cross-market preference correlation specifies the distribution of customers across linked product markets and is specific to those particular markets – as opposed to the concept of synergies, which may be firm-specific, or the concept of customer preferences, which are specific to individual customers. It is a form of customer heterogeneity (Adner & Zemsky, 2006) that shapes the impact of customer-specific synergies at both the firm and industry levels.

MODEL ASSUMPTIONS

We examine the effects of firms exploiting customer-specific synergies via an analytical model to give our argument precision, logical consistency, reproducibility, and a clear audit trail (Adner *et al.*, 2009). We use the simplest possible model with two firms selling to the same customers across two markets. As a benchmark, we first present a baseline model with symmetric firms and no synergies. We next extend this baseline by giving one firm a proprietary customer-specific synergy, with no possibility of imitation by the other firm, in order to derive the profitability of such proprietary synergies. We then relax this inimitability assumption and examine the second firm's incentives to imitate the synergy, thereby leaving both firms with the same synergy. In both the proprietary case and the imitation case, we show how customer-specific synergies change the type of competition in a way that induces market convergence. In each model, we consider two types of synergies – one that cuts the firm's cost to serve customers who buy both products from it (i.e., 'cost-based'), and one that gives greater benefits/WTP to customers who buy both products from the firm (i.e., 'differentiation-based').

Baseline model

We extend the linear single-product Hotelling model of horizontal differentiation (D'Aspremont, Gabszewicz, & Thisse, 1979; Hotelling, 1929) to two products. Such 'Hotelling square' models have been used in economics to assess the desirability of standardization for sellers of complementary products (Matutes & Regibeau, 1988; 1992) or the use of bundling to deter entry (Nalebuff, 2004), as well as in strategy research on platform bundling (Eisenmann, Parker, & Van Alstyne, 2011). Two firms $i \in \{A, D\}$ each produce their own version of the same two products $k \in \{1,2\}$, which are sold in indivisible units. As illustrated in Figure 1, the firms compete for customers distributed inside a unit-size 'Hotelling square', with firm A (for advantaged) at the square's lower-left corner $(X_1 = 0, X_2 = 0)$ and firm D (for disadvantaged) at the square's upper-right corner $(X_1 = 1, X_2 = 1)$. A customer's intrinsic preference for the type of product 1 is represented as her position on the horizontal dimension (X_1) and her preference for the type of product 2 is represented as her position on the vertical dimension (X_2). We also assume that customers' reservation prices are high enough for both markets to be "covered" – i.e., every customer purchases one product from each market. Each customer only needs one unit of each product, either from the same firm or from different firms. The resulting four purchase options are: both products from firm A (option AA), both products from firm D (option DD), product 1 from firm A and product 2 from firm D (option AD), or product 1 from firm D and product 2 from firm A (option DA).

****** Insert Figure 1 about here. ******

As is customary in Hotelling models, in order to give them their horizontal-differentiation properties, the total consumption cost incurred by a consumer includes not only the price(s) the selling firm(s) charge for any product(s), but also an additional cost, typically called 'transport costs,' of $\alpha > 0$ per unit of horizontal distance from her horizontal position to the horizontal position of the firm selling her product 1, plus α per unit of vertical distance from her vertical position to the vertical position of the firm selling her product 2. These 'transport costs' can be viewed as a generic class of different types of costs or inconveniences that may be experienced by a customer, such as search costs, learning costs, tailoring or adaptation costs, or a disutility from consuming products that do not exactly match her ideal preference. The transport-cost parameter α merely serves as a scaling factor in the model – i.e., the results can be made identical for all positive values of α by simply dividing the synergy-magnitude parameter δ (which is described later, in the following sub-section), as well as all margins and profits, by α. So, for simplicity, and without loss of generality, one could simply set $\alpha = 1$ for the remainder of the analysis. Thus, in the baseline model, the monetary value of a customer's transport cost for product k is αX_k when buying from firm A, or $\alpha(1 - X_k)$ when buying from firm D. Each customer chooses whichever option (AA, AD, DA, or DD) gives her the lowest total consumption cost (t_{AA}, t_{AD}, t_{DA}, or t_{DD}), which is the sum of prices paid and transport costs incurred. Later, we will adjust the transport costs in order to boost WTP for versions of the model where synergies are in the form of increased benefits experienced by customers, i.e., differentiation-based synergies (bottom row of Tables 1 and 2). Our baseline assumption, to be altered later, is that all firms have constant marginal production costs of γ per unit of either product sold, and no fixed costs. Later, we will change these marginal cost assumptions for the version of the model with cost-based synergies (top row of Tables 1 and 2).

The parameter λ captures the cross-market preference correlation – i.e., the relative prevalence of customers who intrinsically prefer buying both products either from the same firm or from different firms. We take λ as exogenous – i.e. it cannot be manipulated by firms. We use the method of Morgenstern (1956) to generate the following bivariate family of joint probability density functions with uniform marginal distributions: $f(X_1, X_2; \lambda) = 1 + 4\lambda(0.5 - X_1)(0.5 - X_2)$ with $\lambda \in [-1,1]$, where (X_1, X_2) lies within the Hotelling square, so that $\lambda/3$ is the actual correlation between X_1 and X_2. At the upper extreme of $\lambda = 1$, the greatest proportion of customers are loyal to their particular preferred firm across products so that, as shown on the right side of Figure 2, customers are concentrated in the on-diagonal quadrants between firm A's corner of the square and firm D's corner. At the lower extreme of $\lambda = -1$, the greatest proportion of customers are disloyal to firms across markets, or are averse to one-stop shopping, or have a preference for combining products from different firms, so that, as shown on the left side of Figure 2, customers are concentrated in the off-diagonal quadrants between the two corners of the square that do not have firms. In the intermediate case of $\lambda = 0$, the proportions of loyal and disloyal customers are equal, so that customers are distributed uniformly throughout the square. To calculate the corresponding total quantities demanded, which we denote as $q_{AA}, q_{AD}, q_{DA}, q_{DD}$, the density function above is integrated over each of the regions of the Hotelling square where customers choose each of the four purchasing options, i.e., AA, AD, DA, and DD.

****** Insert Figure 2 about here. ******

Following Matutes and Regibeau (1992), the model is a two-stage game between the firms. In the first stage, each firm chooses one of the following three cross-market strategies: (1) a pure product strategy, where its two products are only sold separately with their own individual prices, p_{1i} and p_{2i}, (2) a pure bundling strategy, where its two products are only sold together with a single price for the combined bundle, p_{12i}, or (3) a mixed bundling strategy, where its products are sold both separately with an individual price for each and together with a single price for the combined bundle. In the case of mixed bundling, its combined bundle price cannot be higher than the sum of its individual product prices, or else no customer would ever buy the bundle.

Yet the choice of cross-market strategy is about more than just pricing policy. For example, bundling often commits a firm to changes in a product's design or packaging that may be difficult to reverse, such as combining a fax, scanner, printer, and copier into the same multi-function device (Matutes & Regibeau, 1992; Stremersch & Tellis, 2002). Pure bundling may also be a strategic decision that a company makes in order to keep more of the benefits from customer-specific synergies for itself. In our model, if either firm chooses a pure bundling strategy, then the other firm is, in effect, forced into a *de facto* pure bundling strategy as well, because customers will be unable to buy just one of its products, even if it prices them separately. As we discuss later, if firms engage in a pure bundling strategy, the industry-level effect will be market convergence. So, the first-stage game has only five possible *de facto* outcomes: (1) pure bundling strategies for both firms, (2) pure product strategies for both firms, (3) mixed bundling strategies for both firms, (4) pure product strategy for A and mixed bundling strategy for B, and (5) mixed bundling strategy for A and pure product strategy for B.

In the first stage of the model, we assume that actual cross-market strategies are non-cooperatively determined via simultaneous-move Nash equilibrium, and that if multiple Nash equilibria in cross-market strategies are possible, the Pareto-dominant equilibrium prevails. After choosing cross-market strategies in the first stage, the firms then set their prices in the second stage via non-cooperative simultaneous-move Nash equilibrium. The model is solved via backward induction: We first find the second-stage Nash equilibrium in prices for every *de facto* possible combination of cross-market strategies, and we then compare these various price equilibria to determine the first-stage Nash equilibrium in cross-market strategies.

In the second stage, firms compete on price and, consistent with all standard models of differentiation, we assume that firms cannot price discriminate due to the informational challenge of learning each individual customer's WTP. We also rule out any form of collusion between the two firms, including, but not limited to, *quid pro quo* arrangements where each firm monopolizes one market. Due to the symmetry of this baseline model's assumptions, the solution is also symmetric (see Matutes & Regibeau, 1988; 1992): Both firms choose a pure product strategy in the first stage, and as shown in Figure 1a, both markets are split evenly in the second stage, with equilibrium prices, outputs, and profits of $p_{1A}^* = p_{2A}^* = p_{1D}^* = p_{2D}^* = \alpha + \gamma$, $q_{AA}^* = q_{AD}^* = q_{DA}^* = q_{DD}^* = 1/4$, and $\pi_A^* = \pi_D^* = \alpha$, where the asterisk denotes Nash equilibrium.

Customer-specific synergies and the trade-off faced by firms

We now examine the effect of customer-specific synergies with a magnitude of $\delta \geq 0$. This synergy-magnitude parameter is used differently in the cost-based synergy and differentiation-based synergy versions of the model – either reducing the production costs incurred by the firm (in the cost-based synergy version) or reducing the transport costs incurred by the customer[1] (in the differentiation-based synergy version), but never both in the same version of the model. If a firm enjoys a cost-based synergy, then its combined marginal production cost for supplying both products together to a given customer are reduced from 2γ in the baseline

[1] One can interpret δ either as an increase in the monetary value of the utility that customers derive from the products or as a lump-sum decrease in customers' transport costs. Both interpretations have an equivalent impact on consumer surplus, and thus yield identical results. Strictly interpreting δ as a lump-sum reduction in transport costs would mean that customers who are sufficiently close to firm A have negative transport costs, but this is just mathematically equivalent to them having an increase in utility.

no-synergy model down to $2\gamma - \delta$ under the synergy, where $\gamma \geq \delta/2$ to rule out negative costs. If a firm has a differentiation-based synergy, then any customer who buys both products from it enjoys a reduction of size δ to her total combined transport costs, which increases her WTP by δ for the combination of both products from that firm. These assumptions apply both to cases where synergies are inimitable/nonsubstitutable (i.e., proprietary to one firm) and to cases where synergies can be imitated by the initially disadvantaged firm.

****** Insert Tables 1 and 2 about here. ******

The resulting demand and profit functions are shown in Tables 1 and 2. Unfortunately, in the general case with nonzero values of δ and λ, these functions yield highly nonlinear first-order conditions for which there are no tractable closed-form solutions of the second-stage price equilibrium. Such tractable closed-form solutions can only be found in either the symmetric no-synergy baseline case discussed in the previous subsection, or in the special case of $\lambda = 0$. So, for any case with positive synergies and nonzero λ, we use Newton's method to find a numerical approximation for the solution of the first-order conditions. We calculate these numerical approximations repeatedly for several hundred combinations of parameter values, spread out across the entire parameter space, and we then use these numerical solutions as data to generate a near-perfect least-squares estimate (with a fit of $R^2 > 0.99$) for the equilibrium prices as a polynomial function of the parameters. We then calculate derivatives of these estimated functions with respect to the underlying parameters for the purpose of doing comparative-statics analysis (see the Appendix for a more detailed explanation).

Before presenting the results of our model, we briefly explain the intuition and key mechanism behind these results. In any market for differentiated products, firms face an inherent trade-off: On one hand, by raising prices, a firm can more fully exploit its market power over "safe" customers who are not at any serious risk of switching to another seller, but at the expense of losing "marginal" customers who are close to indifferent between it and another seller. On the other hand, by lowering prices, a firm can better attract those marginal customers, but at the expense of under-exploiting its market power over safe customers. Profit maximization requires striking an optimal balance between these two approaches. If synergies were not customer-specific, any marginal customer on either market would be equally lucrative to the firm, so the two markets would be disconnected in the firm's decision-making. In that case, the firm could simply maximize its total profit by choosing a price in each market that maximized its profit in that particular market. However, when synergies are customer-specific, some marginal customers are more lucrative than others, and this affects the optimal balance between exploiting safe customers and attracting marginal customers, which in turn affects firms' cross-market strategies. Because customer-specific synergies require a firm to serve the same customers across product markets, the effects of such synergies depend on whether customers do indeed concentrate their purchases to one firm or spread them across different firms. Consequently, the most attractive customers are what we call *split-purchase marginal customers* – i.e., customers who would be willing to buy both products from the same firm if it were to marginally drop its price for one product, but who would otherwise purchase each product from a different firm. As split-purchase marginal customers become more numerous, a firm with a customer-specific synergy shifts its optimal balance toward attracting more marginal customers and away from exploiting safe customers, which intensifies rivalry between firms. The relative prevalence of such split-purchase marginal customers depends on the distribution of customers in the Hotelling square, as represented by the cross-market preference correlation λ. Thus, the intensity of rivalry depends on how firms set their bundling and pricing strategies as a function of the distribution of customer preferences.

As long as both markets are covered (as we have assumed), we have proven numerically that it is never a Nash equilibrium for either firm to choose a mixed bundling strategy, regardless of whether synergies are inimitable/proprietary or imitable/shared, cost-based or differentiation-based.[2] So, the only two possible first-stage equilibria are for both firms to use a pure product strategy or for both firms to use a pure bundle strategy. For each of these two possible equilibria, and for synergies that are either differentiation-based or cost-based synergies, and either inimitable/proprietary or imitable/shared, Tables 1 and 2 show how customer-specific synergies change demand and profit functions. As detailed in the Appendix, we use numerical methods on these functions to approximate equilibrium solutions and derive comparative-statics results.

[2] The very lengthy numerical proof of this result is available from the authors upon request. This result occurs because mixed bundling would allow firms to intensify their rivalry for the lucrative split-purchase marginal customers. Under our assumptions, both firms profit by jointly committing to avoid this intensification of rivalry. However, relaxing our assumption of full market coverage would lead to mixed bundling sometimes dominating the other strategies, as in Matutes and Regibeau (1988; 1992), because more price rivalry would then bring more customers into the market. Likewise, having more than two competitors may also lead to mixed bundling, because their rivalry would already be so intense that further intensifying it would not matter much. The fact that real-world firms engage in mixed bundling is an opportunity for future research to examine how relaxing our assumptions affects this outcome.

RESULTS

Next, we translate our numerically derived comparative-statics results into propositions about three types of outcomes: (1) the performance effect of exploiting a customer-specific synergy when it is kept inimitable and proprietary to firm A, (2) the incentive for firm D to imitate these synergies when this inimitability assumption is relaxed, and (3) the effect of these on the type of competition – i.e., whether and when market convergence arises endogenously. For each of these three types of outcomes, we first explain the intuition and mechanisms behind our results before formally summarizing these results in the form of propositions.

Profitability of proprietary customer-specific synergies

Because our model is solved by backward induction, we start by presenting the results of the second stage of the game.[3] Specifically, consider the performance effect of exploiting a customer-specific synergy when it is available to, and kept proprietary to, firm A, which thus gains a competitive advantage over firm D. We examine how firm A manages the above-mentioned balance between exploiting safe and attracting marginal customers. Because customer-level price discrimination is assumed to be informationally impossible, and because mixed bundling is never an equilibrium of the first-stage game (as previously discussed in footnote 2), we need only consider how firm A strikes this balance when both firms decide on pure product strategies (which happens, as we will demonstrate in the following section, when δ is below a threshold value δ^T) or pure bundling strategies (when δ is above δ^T) in the first stage. We examine each of these scenarios in turn.

When both firms choose pure product strategies – i.e., in green regions of Figures 3 through 6 – firm A's goal of selectively attracting only the split-purchase marginal customers (with whom the synergy could create value) while letting firm D take other marginal customers can be accomplished more effectively when the synergy is differentiation-based rather than cost-based. In the differentiation-based case, customers directly experience the synergistic benefits of concentrating their purchases and thus "self-select" into buying both

[3] In our model, like virtually all multi-stage economic models, firms rely on rational expectations about later-stage outcomes in order to inform the decisions that they make during earlier stages. Thus, the equilibrium solution for our second-stage game is a required input into the first-stage game. Logically, the equilibrium for the first-stage game cannot be solved without first solving the equilibrium for the second stage. Due to this necessity for backward induction, it is customary to present the second-stage results of economic before the first-stage results, both in the economics literature (e.g., Matutes & Regibeau, 1992) and in the strategy literature (e.g., Brandenburger & Stuart, 2007; Chatain & Zemsky, 2007; Makadok & Ross, 2013). Accordingly, we follow this convention by presenting the results of the two stages in logical order (second stage followed by first stage), instead of chronological order.

products from firm A. By contrast, under the cost-based case, only firm A directly benefits from the synergies, so customers have no incentive to buy both products from firm A unless it reduces its prices. However, under a pure product strategy, firm A cannot selectively reduce prices only for split-purchase marginal customers, and thus has no lever to use for attracting only those customers. So, despite the apparent symmetry between the firm's cost and the customer's WTP at a common synergy magnitude of δ, the outcomes of these two synergies differ. As the green regions in Figure 5 indicate, as long as firms choose pure product strategies, price cuts are more effective in selectively attracting split-purchase marginal customers, which thereby induces more rivalry, when synergies are differentiation-based than when cost-based (Figures 1c vs. 1d).

****** Insert Figures 3 through 6 about here. ******

Viewed geometrically in Figure 1, firm A's customer-specific synergy only adds economic value in the AA region of the Hotelling square. So firm A has an incentive to expand the AA region relative to the AD or DA regions, by selectively attracting split-purchase marginal customers along the horizontal and vertical borders of the AA region to choose AA (see Figures 1c and 1d). In the differentiation-based case, firm A can accomplish this selective expansion because split-purchase marginal customers have an incentive to choose AA in order to gain the resulting WTP boost, in which case the AA borders shift more than the DD borders do, as shown in Figure 1d, thereby selectively expanding the AA region. From a customer's perspective, in the differentiation-based case, the WTP boost from choosing AA creates a linkage between her purchase decisions for the two markets, so that those two decisions are no longer independent, and this linkage separates the AA/AD and DA/DD horizontal borders, as well as separating the AD/DD and AA/DA vertical borders, as shown in Figure 1d. Also, because the benefits of the synergy accrue to customers in the differentiation-based case, split-purchase marginal customers can, in effect, play the two firms off against each other by exploiting firm A's desire to selectively expand only the AA region, thereby triggering highly aggressive price rivalry between the firms. On the other hand, if the customer-specific synergies are cost-based, then customers have no incentive to selectively expand the AA region, and since firm A can neither price discriminate nor offer discounted bundle pricing under the pure-product strategy, it has no lever that it could use to induce them to do so. In that case, customers make each product's purchase decision independently, on the basis of that product's price alone, so that the borders of the AA and DD regions shift together, as shown in Figure 1c. This also leaves split-purchase marginal customers unable to exploit firm A's desire to selectively expand only the AA region by inciting highly aggressive price rivalry that plays the two firms off against each other. So, as long as firms use pure-product strategies, firm A gains more from price cuts, and thus uses them more aggressively, thereby inciting more rivalry, in the differentiation-based case than in the cost-based case – as indicated by steeper declines in the green regions of Figures 5b-A and 5b-B than in the green regions of Figures 5a-A and 5a-B.

Finally, rivalry also varies with the degree of cross-market preference correlation λ because there tend to be more split-purchase marginal customers at lower levels of λ. This leads to the degree of rivalry being a decreasing function of λ, under both cost-based and differentiation-based synergies. In the case of differentiation-based synergies, the increase in rivalry may be so severe that the marginal profitability of exploiting a proprietary customer-specific synergy can turn negative (i.e., $\partial\pi_A^*/\partial\delta < 0$). In some cases, this rivalry can be so intense that exploiting customer-specific synergies would actually cause firm A's profit to be lower than it would have been without any synergies at all, even though the synergies are positive and kept proprietary (see Figure 4). This rivalry-induced 'backfiring' is driven by firm A's desire to attract split-purchase marginal customers for which it competes aggressively with firm D, and therefore is greatest when there are relatively many split-purchase marginal customers, which especially occurs when the cross-market preference correlation λ is negative. Likewise, as noted earlier, rivalry tends to be more intense when proprietary customer-specific synergies are differentiation-based than when they are cost-based, so backfiring occurs over a wider range of conditions in the differentiation-based case than in the cost-based case. More generally, even if the rivalry induced by the structure of customer preferences does not lead to backfiring, it still influences the absolute level of profitability that may be gained from a customer-specific synergy. Because lower or more negative levels of cross-market preference correlation λ induce higher degrees of rivalry, the profitability of a firm with proprietary customer-specific synergies is higher in product market combinations that exhibit higher cross-market preference correlation, as shown in Figure 6. We thus propose:

Proposition 1a: When the firms use pure product strategies, both the total profitability and the marginal profitability $\partial\pi_A^*/\partial\delta$ of exploiting a proprietary customer-specific synergy depend on whether the synergy is cost-based or differentiation-based. In particular, if the proprietary synergy is differentiation-based, the marginal profitability of exploiting it is negative when the cross-market preference correlation λ and the synergy magnitude δ are both low, and positive otherwise. However, if the proprietary synergy is cost-based, the marginal profitability of exploiting it is positive, except for being negative when the cross-market preference correlation λ is strongly negative and the synergy magnitude δ is moderate.

Proposition 1b: When the firms use pure product strategies, the performance of a firm with a proprietary customer-specific synergy generally is larger when the cross-market preference correlation λ is higher.

When both firms use pure bundling strategies – i.e., in red regions of Figures 3 through 6 – there are no split-purchase marginal customers because neither firm sells separate products, so customers can only choose between AA and DD bundles (see Figure 1b). Without any split-purchase marginal customers to pursue, firm A has no reason to specifically target those customers, in which case the difference between cost-based and differentiation-based synergies is irrelevant. Firm A still faces a trade-off between exploiting safe and attracting marginal customers, but the absence of split-purchase marginal customers under pure bundling competition sharply reduces rivalry so that both the marginal profitability of exploiting a proprietary customer-specific synergy is always positive (i.e., $\partial\pi_A^*/\partial\delta > 0$). We also find that the profitability of a firm with proprietary customer-specific synergies decreases with cross-market preference correlation λ when δ is high, as shown in the orange "flooded" areas in Figure 6, but increases otherwise. So, we conclude:

Proposition 2a: When the firms use pure bundling strategies, the total profitability and the marginal profitability $\partial\pi_A^*/\partial\delta$ of exploiting a proprietary customer-specific synergy is independent of whether the synergy is cost- or differentiation-based, and the marginal profitability $\partial\pi_A^*/\partial\delta$ is always positive.

Proposition 2b: When the firms use pure bundling strategies, the higher the cross-market preference correlation λ, the lower the performance of a firm with a proprietary customer-specific synergy will be when δ is high and the higher its performance will be otherwise.

Customer-specific synergies and endogenous market convergence

Comparing the two sets of propositions above, we see that the performance of customer-specific synergies depends on whether firms use pure product strategies or pure bundling strategies. Their choice of cross-market strategy, however, is endogenously determined in the first stage of the model as a function of the synergy magnitude δ. In the following we examine firms' initial choice of cross-market strategy, including both the cases where customer-specific synergies can be kept proprietary (as above) and where firm D may imitate these synergies. (Later, we consider firm D's strategic decision about whether to imitate.)

Pure bundling for both firms is a possible equilibrium, but not necessarily the Pareto dominant equilibrium, at all possible parameter values in both the proprietary and imitation cases, under both cost-based and differentiation-based synergies. A pure product strategy for both firms is an equilibrium only when δ is small, but whenever it is an equilibrium, it Pareto dominates the pure bundling equilibrium.[4] Because no other combinations of cross-market strategies are ever equilibria under customer-specific synergies, whether proprietary or not (per footnote 2), pure product competition prevails for sufficiently small values of δ, and pure bundling competition prevails for larger values of δ, as shown by the color differences in Figure 7. So, there is a threshold value δ^T above which a customer-specific synergy between two markets can actually change the very nature of competition in those markets – from competition on individual products to competition on product bundles. Both when synergies are proprietary and when they can be imitated, if the synergy strength δ gets high enough, the two markets are no longer distinct but, in effect, converge into a single market. We call this result *market convergence*, which we define, in line with Greenstein and Khanna (1997) and Stieglitz (2003), as a shift of competition away from individual products towards integrated product bundles.

The exact value of the threshold δ^T where the markets converge depends on three factors: (1) the cross-market preference correlation λ, (2) whether the customer-specific synergy is cost-based or differentiation-based, and (3) whether the synergy is kept proprietary or is shared across the firms (i.e., imitated or not). In the case of a proprietary synergy, the threshold δ^T is shown as the border between the green and beige regions in Figure 7a (which also corresponds to the border between the green and red regions in Figures 3a, 4a, and 6a) when the synergy is cost-based, or as the border between the blue and red regions in Figure 7b (which also corresponds to the border between the green and red regions in Figures 3b, 4b, and 6b) when the synergy is differentiation-based. In the case of a synergy that is shared/imitated across firms, the threshold δ^T is shown as the border between the beige and red regions in Figure 7a when the synergy is cost-based, or as the border between the green and blue regions in Figure 7b when the synergy is differentiation-based.

****** Insert Figure 7 about here. ******

The reason why market convergence arises in our model is that increased customer-specific synergies lead to greater rivalry to attract split-purchase marginal customers, and at some point this rivalry gets so

[4] The pure product equilibrium even Pareto dominates the pure bundling equilibrium in areas where the pure product equilibrium leads to backfiring, despite the pure bundling equilibrium's lower rivalry. This is because both firms' baseline profitability is much lower under the pure bundling equilibrium than under the pure product equilibrium at parameter values where there is backfiring.

intense that the firms would be better off if there were no split-purchase marginal customers to fight over. At this point, switching to the pure bundling equilibrium eliminates all split-purchase marginal customers, which benefits both firms by reducing rivalry. So, our results thus imply that the question of whether markets will converge – i.e., whether we see bundles of products competing in a single market, as opposed to individual products competing in separate markets – depends on the strength of customer-specific synergies:

Proposition 3: If customer-specific synergies become sufficiently strong (above a threshold value δ^T), competition will shift from individual products to product bundles – i.e., converging to a single market.

Although a sufficiently high value for the synergy strength δ can cause market convergence both when synergies are proprietary and when they are imitated, the threshold level for market convergence may differ between these cases. As Figure 7 shows, when customer-specific synergies are imitated by competitors, the markets converge more easily (i.e., at a lower threshold value δ^T) when the synergies are differentiation-based (blue/green border in Figure 7b) than when they are cost-based (beige/red border in Figure 7a). Cost-based synergies also lead to market convergence at a lower threshold δ^T in the proprietary case (green/beige border in Figure 7a) than in the imitation case (beige/red border in Figure 7a). However, under differentiation-based synergies, this relationship is reversed, with market convergence occurring at a lower threshold δ^T in the imitation case (green/blue border in Figure 7b) than in the proprietary case (blue/red border in Figure 7b).

These differences occur because the firms' motivations to compete aggressively on price are strengthened by differentiation-based customer-specific synergies and weakened by cost-based customer-specific synergies, but this strengthening/weakening applies to both firms in the imitation case, whereas it applies only to one firm in the proprietary case. So, strengthening a customer-specific synergy increases rivalry more quickly in the imitation case than in the proprietary case when the synergy is differentiation-based, but increases rivalry more quickly in the proprietary case than in the imitation case when the synergy is cost-based. So, as a cost-based customer-specific synergy strengthens, market convergence occurs sooner in the proprietary case than in the imitation case. Conversely, as a differentiation-based customer-specific synergy strengthens, market convergence occurs sooner in the imitation case than in the proprietary case. We also see in Figure 7 that cross-market preference correlation also affects the threshold δ^T, but in a way that depends upon the type of advantage. So, we conclude:

> ***Proposition 4a:*** When customer-specific synergies are cost-based, market convergence occurs at a lower threshold level of synergy δ^T if synergies are kept proprietary than in the case of imitation. The gap between these two thresholds shrinks as cross-market preference correlation λ increases.
> ***Proposition 4b:*** When customer-specific synergies are differentiation-based, market convergence occurs at a higher threshold level of synergy δ^T if synergies are kept proprietary than in the case of imitation. The gap between these two thresholds grows as cross-market preference correlation λ increases.

The fact that the propensity to converge differs between the cost-based and the differentiation-based cases also leads to a difference between the two cases on the effect of imitation if the value of the customer-specific synergy lies between the two threshold values. In the case of differentiation-based synergies, imitation by firm D may lead to market convergence. Interestingly, in the case of cost-based synergies, imitation by firm D may lead to market *divergence*, i.e. competition shifting from pure bundling to pure products.

> ***Proposition 5a:*** When the strength of a cost-based customer-specific synergy lies between the thresholds in Proposition 4a, imitation triggers market divergence (product bundles to separate products).
> ***Proposition 5b:*** When the strength of a differentiation-based customer-specific synergy lies between the thresholds in Proposition 4b, imitation triggers market convergence (separate products to product bundles).

Incentives to imitate customer-specific synergies

Finally, we consider firm D's decision about whether to imitate a proprietary synergy held by firm A. This is a strategic decision for firm D since it must take into account how its imitation would influence firm A's choices in both stages of the model, i.e., its cross-market strategy and its pricing. We calculate firm D's benefit from imitation, defined as the difference between firm D's profit if it chose to imitate and its profit under the corresponding proprietary version of the model where it does not imitate. Firm D would rationally imitate if and only if this benefit exceeds some exogenously-determined cost of imitation.

It is natural to expect that, as a synergy strengthens, the benefit that firm D obtains from imitating it would increase. However, we obtain the counter-intuitive result that increasing the strength of a synergy sometimes decreases the benefit of imitating it. This negative marginal effect occurs under both cost-based and differentiation-based synergies, but for different reasons and in different regions of the parameter space, as shown in Figure 7. Under cost-based synergies, the negative marginal effect occurs when the strength of the synergy lies between the threshold values where market convergence takes place in the proprietary case versus the imitation case, as shown in the beige region of Figure 7a. The reason for this unexpected result is that imitation can trigger a change in market structure and the type of competition, as noted in Proposition 5a. So, when the synergy strength lies between these two threshold values, imitation causes market divergence, where a market for product bundles separates into markets for individual products. This, in turn, triggers a strong increase in the intensity of price rivalry, which is what causes the marginal effect on the benefits of imitation to become negative. Under differentiation-based synergies, the negative marginal effect in Figure 7b occurs when the strength of the synergy and the cross-market preference correlation are both low. This is the same region of parameter space where strengthening the synergy, even if kept proprietary, backfires against firm A, as discussed earlier in Proposition 1a. If it backfires even in the proprietary case, it is certainly not surprising to see that it would also backfire against an imitator as well. So, we conclude:

Proposition 6a: When a customer-specific synergy is cost-based and its strength lies between the market-convergence thresholds for the proprietary and imitation cases (from Proposition 4a), the benefit from imitating the synergy is decreasing in its strength due to triggering a rivalry-inducing market divergence.
Proposition 6b: For a differentiation-based customer-specific synergy, when the synergy strength and the cross-market preference correlation are both low (approximately the backfiring region from Proposition 1a), the benefit from imitating the synergy is also decreasing in its strength.

DISCUSSION

In this article, we examine the nature and effects of customer-specific synergies, which have been under-researched compared to the more familiar shared-resource synergies. Customer-specific synergies behave differently than synergies that arise purely from resource sharing alone. Our results highlight the effect that demand-side variables like customer preference structure have on the outcomes of customer-specific synergies, and thus provide further motivation to consider such demand-side variables. Specifically, the results of our model speak to three literatures: theories of competitive advantage, theories of firm scope, and theories of market structure. Next, we discuss the implications of our findings for each of these three literatures, and then we discuss some limitations of our approach and provide some suggestions for further study.

Implications for research on competitive advantage

Customer-specific synergies that cannot be imitated by rivals constitute a competitive advantage based on a firm's product market scope, so our results have implications for theories of competitive advantage. It is often assumed that improving one's competitive strength relative to rivals boosts profit, even though some of the increased economic value from such improvements may be appropriated by suppliers and employees (Coff, 1997, 1999), imitative rivals (Grahovac & Miller, 2009; Pacheco-de-Almeida & Zemsky, 2007), or customers who bargain with firms over residual surplus (Brandenburger & Stuart, 1996, 2007).

There are two ways that our results add to recent literature questioning this assumption in order to provide a more nuanced picture of how competitive advantages translate into performance outcomes. First, if deploying an advantage leads to increased product market rivalry, the deployment of an advantage may lead to 'backfiring' – i.e., the advantaged firm may end up with lower performance than if it had not deployed the advantage (our proposition 1a). In the single-market backfiring model of Costa *et al.* (2013), extreme rivalry was induced by a combination of diseconomies of scale and high inter-firm substitutability, which is a rather unusual scenario (their proposition 4). In our two-market model the mechanism is different: The structure of customer preferences induces extreme rivalry. When cross-market preference correlation is low or negative, a greater proportion of customers intrinsically prefer to split their purchases between the two firms. These split-purchase marginal customers are more attractive to a firm with customer-specific synergies than other customers, so any increase to their relative prevalence in the market induces greater price rivalry to attract them, which may lead to backfiring in extreme cases. So, the questions of how customers are distributed in a market and how firms manage the trade-off between exploiting safe customers and attracting marginal customers (especially split-purchase marginal customers, in our case) are crucial in determining how competitive advantages translate to performance (especially when those advantages are customer-specific).

Second, in contrast to the single-market result that the incentive to imitate a competitive advantage rises when the advantage is stronger (e.g., Grahovac & Miller, 2009), we show that in a multi-product setting the incentive to imitate may actually drop when the strengthened advantage is customer-specific in nature. This can occur when imitating would trigger a change in the basis of competition from product bundles to individual products and the resulting rivalry increase would overwhelm the benefit of eliminating the firm's capability disadvantage. This effect is related to a finding by Cabral and Villas-Boas (2005) that when all firms in an industry strengthen their capabilities, increased rivalry may reduce their profit. So, our results raise questions for future research about when strengthening an advantage increases or decreases the incentive to imitate it.

A further result of our model is that an advantaged firm may be able to appropriate a larger part of a proprietary cost-based customer-specific synergy than of a differentiation-based synergy of the same magnitude – at least for most parameter values and when competition is on pure products. The reason is that rivalry is more intense in the differentiation-based case, which conversely means that the degree of customers' bargaining power (Brandenburger & Stuart, 2007) is also a function of the type of synergy and, additionally, arises endogenously through the interaction of synergies and customer preference structure.

Finally, our results extend the resource-based view by shedding light on the performance effect and, by implication, the value of particular types of resources. Generally, the value of a resource depends on how it is matched with particular types of customers or customer segments. In particular, we find that the value of a resource that underlies customer-specific synergies depends on the distribution of customer preferences across markets (cf. Schmidt & Keil, 2013), with some distributions making the value of such a resource negative even though it increases the firm's advantage in creating economic value (i.e., its advantage over rivals in widening the gap between customer WTP and costs). Because cross-market preference correlation may differ between pairs of markets, the value of a resource depends on the particular product market combination over which it is applied. Furthermore, if cross-market preference correlation changes over the industry life cycle, the value of a resource may also be contingent on the timing of its deployment.

Implications for research on firm scope

Accounting for customer-specific synergies augments research on multi-product firms, which has mostly taken a supply-side perspective focused on sharing resources across markets. Such resource sharing may, by itself, motivate many diversification moves, as, e.g., in the case of Honda (Prahalad & Hamel, 1990), but some portion of diversification moves can only be motivated by synergies that go beyond mere resource sharing due to their customer-specific nature, as in the case of Monsanto discussed earlier. Compared to purely resource-sharing synergies, customer-specific synergy motivates a different form of diversification, driven by different factors, with a different causal logic, leading firms to enter different markets, and generating different connections between those markets. Customer preferences and induced rivalry can affect the profitability of exploiting a customer-specific synergy (see our Propositions 1 and 2), which in turn ought to affect firms' incentives to enter markets where such synergies can be exploited. Because the profitability of customer-specific synergies depends on the type of synergy (cost vs. WTP), the structure of customer preferences, and the resulting cross-market strategy equilibrium, a firm's optimal scope decision to exploit customer-specific synergies may be a more complex problem than previously thought. Also, if a firm has a customer-specific synergy, its conduct in a market it enters may depend on the degree of rivalry induced by its entry.

We also shed new light on when and how firms can exploit existing customer relationships when entering new markets (Chatain, 2011; Lemelin, 1982). Specifically, the backfiring effect shows that the mere existence of customer-specific synergies is not a sufficient condition for reaping additional profits when entering new markets that share the same customers; profits ultimately depend on how rivalry is affected by cross-market preference correlation, which is a function of the structure of demand across markets. Interestingly, it is not the negative attitude of customers against buying several products from the same firm *per se*, but the increased rivalry it induces, that limits the extent to which a firm may benefit from a scope advantage.

Our study also complements empirical work examining how synergies across markets affect performance outcomes. A small number of empirical studies have investigated both shared-resource and customer-specific synergies in a single study (Cottrell & Nault, 2004; Nayyar, 1993; Tanriverdi & Lee, 2008). Although these studies have been limited in their theoretical grounding and the idiosyncratic industries they examine, their results are in line with our argument that shared-resource and customer-specific synergies differ substantially in terms of the incentives they provide to firms as well as their performance implications (Cottrell & Nault, 2004; Nayyar, 1993; Tanriverdi & Lee, 2008). Our model provides a formal theoretical rationale for these prior empirical studies in the form of customer-specific synergies, while also providing new hypotheses for empirical testing. Our results suggest that the specific type of synergy should be accounted for in future empirical studies of the profitability of diversification and product-market scope.

Implications for research on industry structure and market convergence

A key implication of our model is that industry and market level phenomena, such as rivalry in an industry (Porter, 1980) or market convergence (Greenstein & Khanna, 1997), may often be the result of firm-level incentives and capabilities. For example, the degree of rivalry in our model is not merely a function of the number of firms in the industry (Porter, 1980) or the degree of frictions (Chatain & Zemsky, 2011), but rivalry is induced by the interaction of the structure of customer preferences with firm-specific competitive advantages. We also find that a fundamental shift in the basis of competition may be triggered either by the deployment of a resource for customer-specific synergy or by a rival's imitation of such a resource. As can be seen from the examples discussed earlier, many industries have experienced at least some degree of market convergence, with competition shifting at least partially from individual products to product bundles. Firms' decisions are thus a driver for such market convergence: Markets may converge as an outcome of firms seeking to exploit customer-specific synergies of a sufficiently strong magnitude (see our proposition 3). The customer-specific synergy concept thus provides a theoretical foundation for studying demand-side drivers of market convergence, a topic that is generally under-researched in strategic management (Benner & Tripsas, 2012) and in particular from a demand-side perspective (Gambardella & Torrisi, 1998; Stieglitz, 2003).

While market convergence is a binary either/or outcome in our simplified and stylized model, it may be more ambiguous and harder to define in situations with more firms, where a broader variety of bundling-strategy equilibria may be possible. In such scenarios, we might see integrated firms that exploit customer-specific synergies competing against specialized firms. We may also see partial convergence across a range of markets, where firms differ in the markets they address and in the particular customer-specific synergies they apply to their particular combinations of markets. For example, in their current competition, Apple, Amazon, Google, and Microsoft partially overlap in the markets where they compete, while partnering in other markets, and employing a variety of synergies and bundling approaches. So, customer-specific synergies can help explain strategies for markets whose customers overlap and the ways these markets may converge.

In addition to providing empirically testable propositions, all of the results discussed above also have actionable implications for practice. They can help multi-product firms make better decisions about synergies by considering their impact on competitive advantage, interfirm rivalry and market convergence. For example, these results may inform a firm's choice about the type of synergies it pursues by showing how the profitability of a customer-specific synergy differs from that of other types of synergies, as well as how it differs according to whether the synergy is based on cost or differentiation. Likewise, by showing how the distribution of customers' preferences across products affects the profitability of a customer-specific synergy, our results may also inform firms' decisions about which particular combination of products a customer-specific synergy should be applied to, and the stage of the product life cycle when it should be deployed. In addition, our results may inform the firm's choice of cross-market strategy for pricing and packaging products either as a combined bundle or as separate components. Likewise, they may inform a firm's choice about whether to imitate a rival's customer-specific synergy, with an eye toward avoiding the potentially detrimental increase in rivalry that could be triggered if imitation motivates competitors to un-bundle their products (i.e., a market divergence). In light of how advancements in information technology are now enabling firms to develop new kinds of customer-specific synergies that would previously have been impossible or uneconomical, all of these actionable implications for practice are likely to become increasingly relevant in the future.

Limitations and opportunities for future research

Our study draws conclusions from an analytical model that focuses on some specific aspects of real-life settings, while abstracting from others. To simplify our model for this initial foray into the theory of customer-specific synergies, we made many restrictive assumptions that may be relaxed in future extensions, such as: the degree of customer overlap between markets, limits on price discrimination and on market demand elasticity, complete coverage of both markets, simultaneous moves, symmetric information, and exclusion of both collusion and dynamic effects/phenomena like market entry or exit. Relaxing these assumptions may yield new insights into customer-specific synergies and greater clarity about the boundary conditions of our results. For example, the mixed bundling strategy may sometimes emerge as a first-stage equilibrium if we were to relax the assumption of full market coverage, which may then alter our results. Furthermore, new insights may be gained by examining additional demand-side conditions that enhance or reduce (or even reverse) the value of competitive advantages. Empirically, it may be fruitful to examine the types of resources that underlie customer-specific synergies, such as "systems integration capabilities" (Hobday, Davies, & Prencipe, 2005), and the corresponding demand-side "scope economies" from combined purchasing, use, maintenance, or disposal of multiple products (Priem, 2007). So, we see our analysis as a mere starting point for a more complete and nuanced future theory of customer-specific synergies.

APPENDIX: SOLVING FOR EQUILIBRIA AND DERIVING COMPARATIVE STATICS

In each of the eight model variations from Tables 1 and 2, each buyer in the Hotelling square chooses whichever one of the four purchase options $k \in \{AA, AD, DA, DD\}$ gives her the lowest total consumption cost function t_k among the four listed in that model's cell in Table 1 or 2. By taking the differences between each pair of cost functions in that cell, setting those differences equal to zero, and solving the resulting equation for either X_1 or X_2, we find the locus of buyers who are indifferent between the corresponding pair of purchase options, which forms the border between the corresponding pairs of regions in Figure 3. These borders are used as bounds for integrating the buyer density function $f(X_1, X_2; \lambda)$ over each of the four regions in Figure 3. The results of these four integrals are the quantities q_k demanded for each of the four purchase options, as shown in Tables 1 and 2. Next, we substitute these quantities into the two firms' profit functions from the same cell in Table 1 or 2, and then differentiate each firm's profit functions with respect to the price or prices that it sets in that version of the model. The resulting derivatives are then set equal to zero to obtain the first-order necessary conditions for price equilibrium in that version of the model.

As noted earlier, due to the intractability of solving the first-order conditions, we rely on numerical methods. Specifically, we use Newton's method to calculate numerical solutions to the first-order conditions for several hundred combinations of parameter values across the entire parameter space, and confirmed that second-order conditions were also satisfied at these numerically-calculated equilibrium points. In order to conduct the comparative-statics analyses shown graphically in Figures 4 and 6 without having closed-form solutions for the equilibria, we use least-squares estimation to construct near-perfect symbolic approximations of the equilibria. In particular, we use the several hundred numerical solutions as data to estimate equilibrium prices, outputs, and profits as multivariate polynomial functions of λ and δ/α (e.g., see Figure 3). These polynomial functions include every possible term of the form $\lambda^g(\delta/\alpha)^h$ with nonnegative integer exponents *g* and *h* whose sum is between 0 and 8, inclusive (a total of 66 polynomial terms). This estimation gave very close approximations of the numerical solutions, with $R^2 > 0.99$. We conduct comparative-statics analysis by differentiating this approximate equilibrium profit function with respect to the model parameters to produce Figures 4 and 6.

Table 1. Total Consumption Cost Functions, Demand Functions, and Profit Functions Under Proprietary Customer-Specific Synergies

	Both Firms Use "Pure Product" Cross-Market Strategies	Both Firms Use "Pure Bundle" Cross-Market Strategies
Cost-Based Synergy	$t_{AA} = (p_{1A} + p_{2A}) + [\alpha X_1 + \alpha X_2]$ $t_{AD} = (p_{1A} + p_{2D}) + [\alpha X_1 + \alpha(1 - X_2)]$ $t_{DA} = (p_{1D} + p_{2A}) + [\alpha(1 - X_1) + \alpha X_2]$ $t_{DD} = (p_{1D} + p_{2D}) + [\alpha(1 - X_1) + \alpha(1 - X_2)]$ $q_{AA} = \frac{\alpha^2(4+\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})+\alpha\lambda[(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-(p_{1A}-p_{1D})]^{-1}[\alpha-(p_{2A}-p_{2D})]^{-1}}$ $q_{AD} = \frac{\alpha^2(4-\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})-\alpha\lambda[(p_{1A}-p_{1D})-(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-(p_{1A}-p_{1D})]^{-1}[\alpha+(p_{2A}-p_{2D})]^{-1}}$ $q_{DA} = \frac{\alpha^2(4-\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})+\alpha\lambda[(p_{1A}-p_{1D})-(p_{2A}-p_{2D})]}{16\alpha^4[\alpha+(p_{1A}-p_{1D})]^{-1}[\alpha-(p_{2A}-p_{2D})]^{-1}}$ $q_{DD} = \frac{\alpha^2(4+\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})-\alpha\lambda[(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha+(p_{1A}-p_{1D})]^{-1}[\alpha+(p_{2A}-p_{2D})]^{-1}}$ $\pi_A = (p_{1A} - \gamma)q_{AD} + (p_{2A} - \gamma)q_{DA} + [(p_{1A} + p_{2A}) - (2\gamma - \delta)]q_{AA}$ $\pi_D = (p_{1D} - \gamma)(q_{DA} + q_{DD}) + (p_{2D} - \gamma)(q_{AD} + q_{DD})$	$t_{AA} = p_{12A} + [\alpha X_1 + \alpha X_2]$ $t_{DD} = p_{12D} + [\alpha(1 - X_1) + \alpha(1 - X_2)]$ $q_{AA} = 1 - \frac{[2\alpha+(p_{12A}-p_{12D})]^2[12\alpha^2-4\alpha\lambda(p_{12A}-p_{12D})+\lambda(p_{12A}-p_{12D})^2]}{96\alpha^4}$ $q_{DD} = \frac{[2\alpha+(p_{12A}-p_{12D})]^2[12\alpha^2-4\alpha\lambda(p_{12A}-p_{12D})+\lambda(p_{12A}-p_{12D})^2]}{96\alpha^4}$ $\pi_A = [p_{12A} - (2\gamma - \delta)]q_{AA}$ $\pi_D = (p_{12D} - 2\gamma)q_{DD}$
Differentiation-Based (WTP) Synergy	$t_{AA} = (p_{1A} + p_{2A}) + [\alpha X_1 + \alpha X_2 - \delta]$ $t_{AD} = (p_{1A} + p_{2D}) + [\alpha X_1 + \alpha(1 - X_2)]$ $t_{DA} = (p_{1D} + p_{2A}) + [\alpha(1 - X_1) + \alpha X_2]$ $t_{DD} = (p_{1D} + p_{2D}) + [\alpha(1 - X_1) + \alpha(1 - X_2)]$ $q_{AA} = \frac{\alpha^2(4+\lambda)+\lambda[\delta-(p_{1A}-p_{1D})][\delta-(p_{2A}-p_{2D})]-\alpha\lambda[2\delta-((p_{1A}-p_{1D})+(p_{2A}-p_{2D}))]}{16\alpha^4[\alpha+\delta-(p_{1A}-p_{1D})]^{-1}[\alpha+\delta-(p_{2A}-p_{2D})]^{-1}}$ $- \frac{12\alpha^2+\lambda[5\delta^2+12(p_{1A}-p_{1D})(p_{2A}-p_{2D})-8\delta((p_{1A}-p_{1D})+(p_{2A}-p_{2D}))]}{96\alpha^4\delta^{-2}}$ $q_{AD} = \frac{\alpha^2(4-\lambda)-\lambda(p_{1A}-p_{1D})[\delta-(p_{2A}-p_{2D})]-\alpha\lambda[\delta+(p_{1A}-p_{1D})-(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-(p_{1A}-p_{1D})]^{-1}[\alpha-\delta+(p_{2A}-p_{2D})]^{-1}}$ $q_{DA} = \frac{\alpha^2(4-\lambda)-\lambda(p_{2A}-p_{2D})[\delta-(p_{1A}-p_{1D})]-\alpha\lambda[\delta-(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-\delta+(p_{1A}-p_{1D})]^{-1}[\alpha-(p_{2A}-p_{2D})]^{-1}}$ $q_{DD} = \frac{\alpha^2(4+\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})-\alpha\lambda[(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha+(p_{1A}-p_{1D})]^{-1}[\alpha+(p_{2A}-p_{2D})]^{-1}}$ $- \frac{12\alpha^2+\lambda[\delta^2+12(p_{1A}-p_{1D})(p_{2A}-p_{2D})-4\delta((p_{1A}-p_{1D})+(p_{2A}-p_{2D}))]}{96\alpha^4\delta^{-2}}$ $\pi_A = (p_{1A} - \gamma)(q_{AA} + q_{AD}) + (p_{2A} - \gamma)(q_{AA} + q_{DA})$ $\pi_D = (p_{1D} - \gamma)(q_{DA} + q_{DD}) + (p_{2D} - \gamma)(q_{AD} + q_{DD})$	$t_{AA} = p_{12A} + [\alpha X_1 + \alpha X_2 - \delta]$ $t_{DD} = p_{12D} + [\alpha(1 - X_1) + \alpha(1 - X_2)]$ $q_{AA} = 1 - \frac{[2\alpha-\delta+(p_{12A}-p_{12D})]^2[12\alpha^2-4\alpha\lambda((p_{12A}-p_{12D})-\delta)+\lambda((p_{12A}-p_{12D})-\delta)^2]}{96\alpha^4}$ $q_{DD} = \frac{[2\alpha-\delta+(p_{12A}-p_{12D})]^2[12\alpha^2-4\alpha\lambda((p_{12A}-p_{12D})-\delta)+\lambda((p_{12A}-p_{12D})-\delta)^2]}{96\alpha^4}$ $\pi_A = (p_{12A} - 2\gamma)q_{AA}$ $\pi_D = (p_{12D} - 2\gamma)q_{DD}$

Table 2. Total Consumption Cost Functions, Demand Functions, and Profit Functions Under Imitated Customer-Specific Synergies

	Both Firms Use "Pure Product" Cross-Market Strategies	Both Firms Use "Pure Bundle" Cross-Market Strategies
Cost-Based Synergy	$t_{AA} = (p_{1A} + p_{2A}) + [\alpha X_1 + \alpha X_2]$ $t_{AD} = (p_{1A} + p_{2D}) + [\alpha X_1 + \alpha(1 - X_2)]$ $t_{DA} = (p_{1D} + p_{2A}) + [\alpha(1 - X_1) + \alpha X_2]$ $t_{DD} = (p_{1D} + p_{2D}) + [\alpha(1 - X_1) + \alpha(1 - X_2)]$ $q_{AA} = \frac{\alpha^2(4+\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})+\alpha\lambda[(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-(p_{1A}-p_{1D})]^{-1}[\alpha-(p_{2A}-p_{2D})]^{-1}}$ $q_{AD} = \frac{\alpha^2(4-\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})-\alpha\lambda[(p_{1A}-p_{1D})-(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-(p_{1A}-p_{1D})]^{-1}[\alpha+(p_{2A}-p_{2D})]^{-1}}$ $q_{DA} = \frac{\alpha^2(4-\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})+\alpha\lambda[(p_{1A}-p_{1D})-(p_{2A}-p_{2D})]}{16\alpha^4[\alpha+(p_{1A}-p_{1D})]^{-1}[\alpha-(p_{2A}-p_{2D})]^{-1}}$ $q_{DD} = \frac{\alpha^2(4+\lambda)+\lambda(p_{1A}-p_{1D})(p_{2A}-p_{2D})-\alpha\lambda[(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha+(p_{1A}-p_{1D})]^{-1}[\alpha+(p_{2A}-p_{2D})]^{-1}}$ $\pi_A = (p_{1A} - \gamma)q_{AD} + (p_{2A} - \gamma)q_{DA} + [(p_{1A} + p_{2A}) - (2\gamma - \delta)]q_{AA}$ $\pi_D = (p_{1D} - \gamma)q_{DA} + (p_{2D} - \gamma)q_{AD} + [(p_{1D} + p_{2D}) - (2\gamma - \delta)]q_{DD}$	$t_{AA} = p_{12A} + [\alpha X_1 + \alpha X_2]$ $t_{DD} = p_{12D} + [\alpha(1 - X_1) + \alpha(1 - X_2)]$ $q_{AA} = 1 - \frac{[2\alpha+(p_{12A}-p_{12D})]^2[12\alpha^2-4\alpha\lambda(p_{12A}-p_{12D})+\lambda(p_{12A}-p_{12D})^2]}{96\alpha^4}$ $q_{DD} = \frac{[2\alpha+(p_{12A}-p_{12D})]^2[12\alpha^2-4\alpha\lambda(p_{12A}-p_{12D})+\lambda(p_{12A}-p_{12D})^2]}{96\alpha^4}$ $\pi_A = [p_{12A} - (2\gamma - \delta)]q_{AA}$ $\pi_D = [p_{12D} - (2\gamma - \delta)]q_{DD}$
Differentiation-Based (WTP) Synergy	$t_{AA} = (p_{1A} + p_{2A}) + [\alpha X_1 + \alpha X_2 - \delta]$ $t_{AD} = (p_{1A} + p_{2D}) + [\alpha X_1 + \alpha(1 - X_2)]$ $t_{DA} = (p_{1D} + p_{2A}) + [\alpha(1 - X_1) + \alpha X_2]$ $t_{DD} = (p_{1D} + p_{2D}) + [\alpha(1 - X_1) + \alpha(1 - X_2) - \delta]$ $q_{AA} = \frac{\alpha^2(4+\lambda)+\lambda[\delta-(p_{1A}-p_{1D})][\delta-(p_{2A}-p_{2D})]-\alpha\lambda[2\delta-(p_{1A}-p_{1D})-(p_{2A}-p_{2D})]}{16\alpha^4[\alpha+\delta-(p_{1A}-p_{1D})]^{-1}[\alpha+\delta-(p_{2A}-p_{2D})]^{-1}} - \frac{3\alpha^2+\lambda[3(p_{1A}-p_{1D})(p_{2A}-p_{2D})-\delta((p_{1A}-p_{1D})+(p_{2A}-p_{2D}))]}{6\alpha^4\delta^{-2}}$ $q_{AD} = \frac{\alpha^2(4-\lambda)-\lambda[\delta+(p_{1A}-p_{1D})][\delta-(p_{2A}-p_{2D})]-\alpha\lambda[2\delta+(p_{1A}-p_{1D})-(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-\delta-(p_{1A}-p_{1D})]^{-1}[\alpha-\delta+(p_{2A}-p_{2D})]^{-1}}$ $q_{DA} = \frac{\alpha^2(4-\lambda)-\lambda[\delta-(p_{1A}-p_{1D})][\delta+(p_{2A}-p_{2D})]-\alpha\lambda[2\delta-(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha-\delta+(p_{1A}-p_{1D})]^{-1}[\alpha-\delta-(p_{2A}-p_{2D})]^{-1}}$ $q_{DD} = \frac{\alpha^2(4+\lambda)+\lambda[\delta+(p_{1A}-p_{1D})][\delta+(p_{2A}-p_{2D})]-\alpha\lambda[2\delta+(p_{1A}-p_{1D})+(p_{2A}-p_{2D})]}{16\alpha^4[\alpha+\delta+(p_{1A}-p_{1D})]^{-1}[\alpha+\delta+(p_{2A}-p_{2D})]^{-1}} - \frac{3\alpha^2+\lambda[3(p_{1A}-p_{1D})(p_{2A}-p_{2D})+\delta((p_{1A}-p_{1D})+(p_{2A}-p_{2D}))]}{6\alpha^4\delta^{-2}}$ $\pi_A = (p_{1A} - \gamma)(q_{AA} + q_{AD}) + (p_{2A} - \gamma)(q_{AA} + q_{DA})$ $\pi_D = (p_{1D} - \gamma)(q_{DA} + q_{DD}) + (p_{2D} - \gamma)(q_{AD} + q_{DD})$	$t_{AA} = p_{12A} + [\alpha X_1 + \alpha X_2 - \delta]$ $t_{DD} = p_{12D} + [\alpha(1 - X_1) + \alpha(1 - X_2) - \delta]$ $q_{AA} = \frac{1}{2} + \frac{(p_{12A} - p_{12D})(\lambda - 3)}{6\alpha} + \frac{(p_{12A}-p_{12D})^2[\lambda(p_{12A}-p_{12D})^2+12\alpha^2(1-\lambda)]}{96\alpha^4}$ $q_{DD} = \frac{1}{2} - \frac{(p_{12A} - p_{12D})(\lambda - 3)}{6\alpha} - \frac{(p_{12A}-p_{12D})^2[\lambda(p_{12A}-p_{12D})^2+12\alpha^2(1-\lambda)]}{96\alpha^4}$ $\pi_A = (p_{12A} - 2\gamma)q_{AA}$ $\pi_D = (p_{12D} - 2\gamma)q_{DD}$

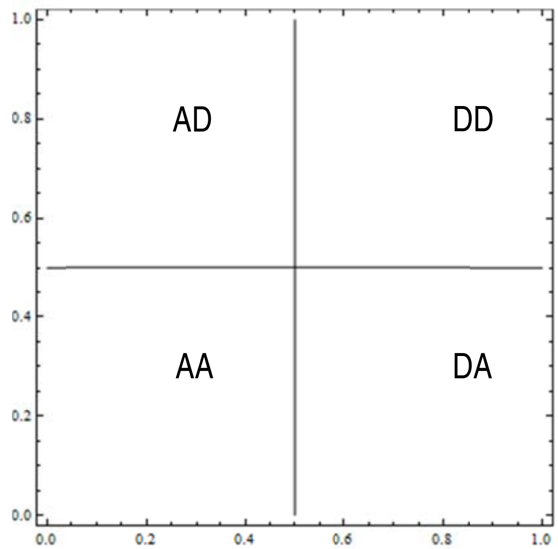


Figure 1a.
Base case without synergies ($\delta/\alpha = 0$)

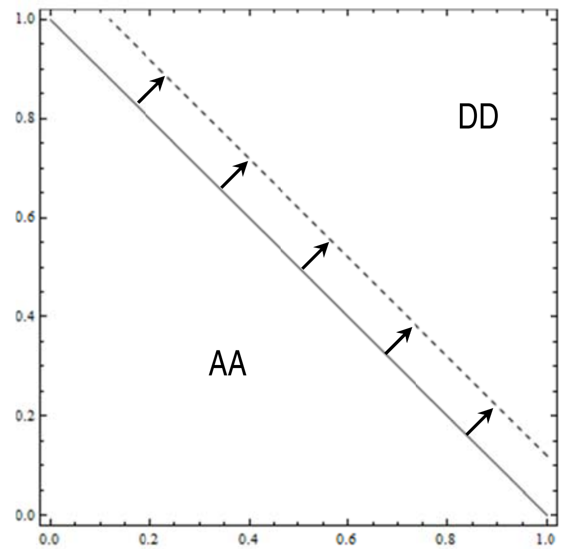


Figure 1b.
Synergies (either cost or differentiation)
when firms use pure bundling strategies

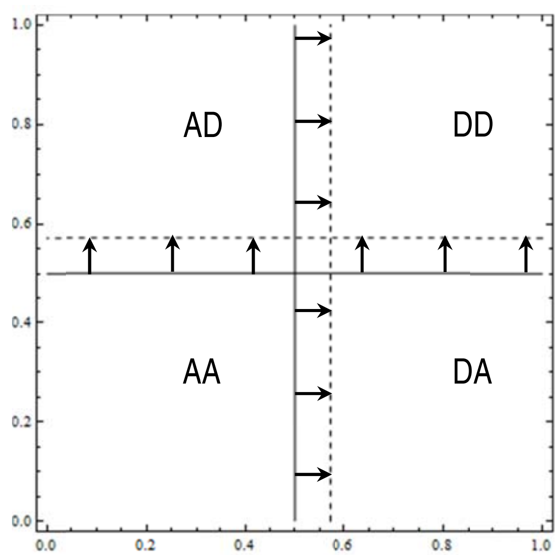


Figure 1c.
Cost-based synergies
when firms use pure product strategies

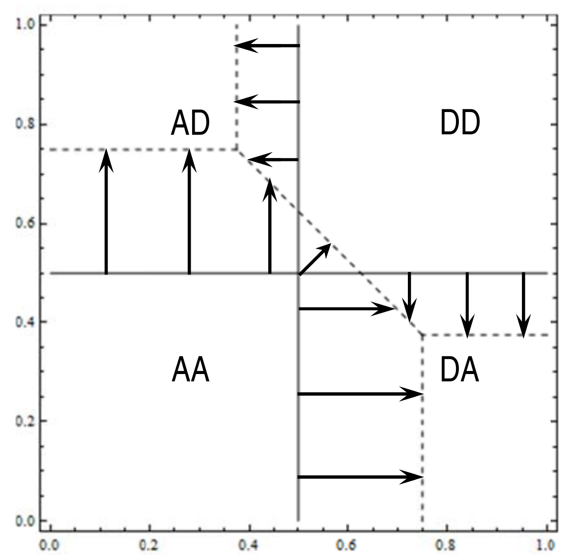
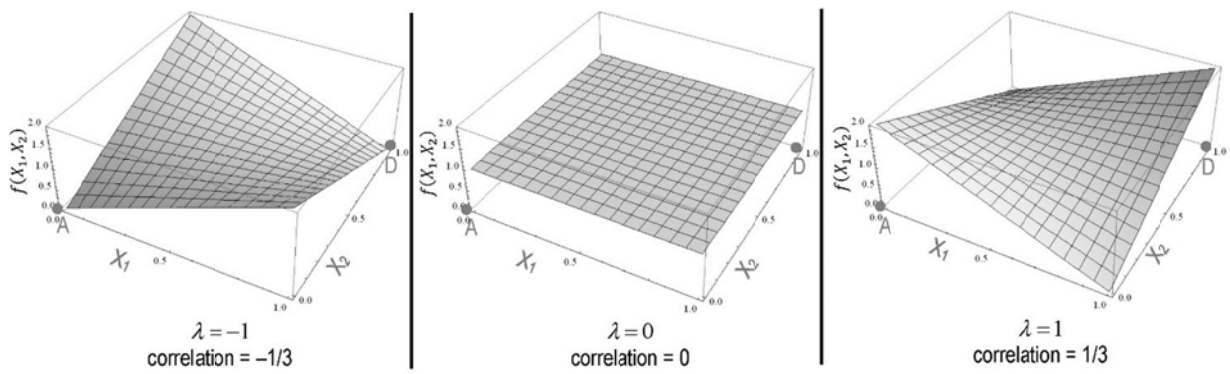


Figure 1d.
Differentiation-based synergies
when firms use pure product strategies

Solid lines represent the region borders when $\delta/\alpha = 0$ and $\lambda = 0$
Dashed lines represent the region borders when $\delta/\alpha = 0.75$ and $\lambda = 0$
Arrows show how the region borders shift when δ/α increases from 0 to 0.75 while $\lambda = 0$

Figure 1. As synergies increase, borders between regions in the Hotelling square shift differently depending on type of customer-specific synergies and the basis of competition.



Graphs show density of buyers in the Hotelling square, $f(X_1, X_2)$, at three different values of the cross-market preference correlation λ.

Possible interpretations of the cross-market preference correlation λ…

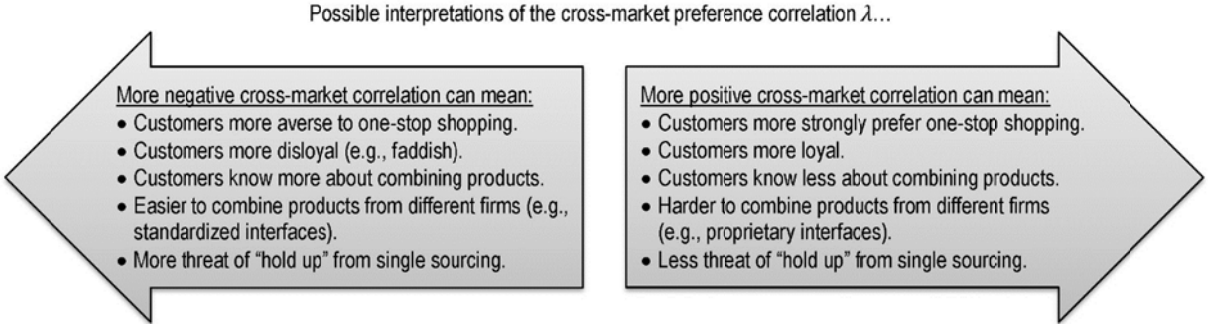


Figure 2. Varying the cross-market preference correlation.

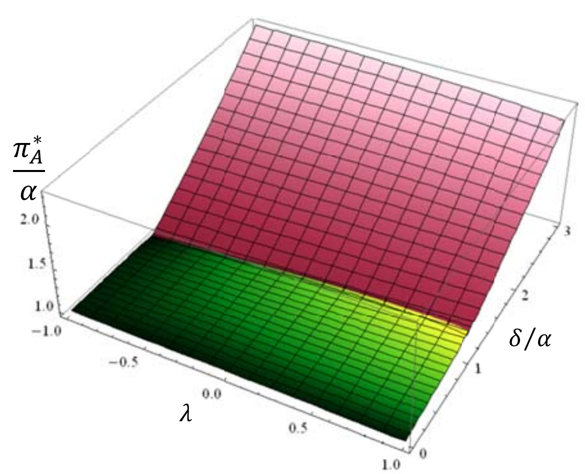


Figure 3a
Firm A's profit under
cost-based synergy,
scaled by transport-cost parameter α

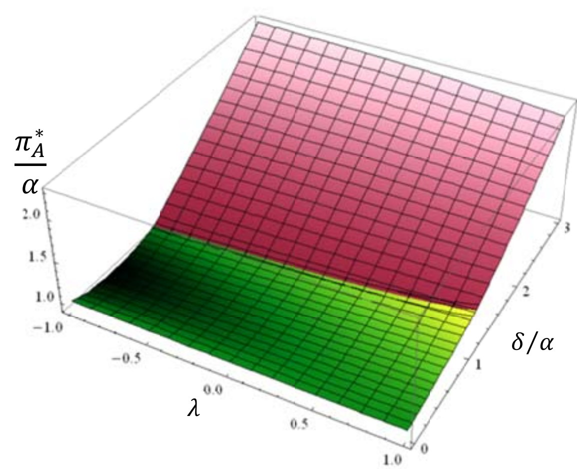


Figure 3b
Firm A's profit under
differentiation-based (WTP) synergy,
scaled by transport-cost parameter α

Green area = Competition under pure product strategies (markets separate)
Red area = Competition under pure bundling strategies (markets converged)

Figure 3. Scaled profit under proprietary customer-specific synergies, π_A^*/α, as a function of cross-market preference correlation parameter, λ, and scaled synergy strength, δ/α.

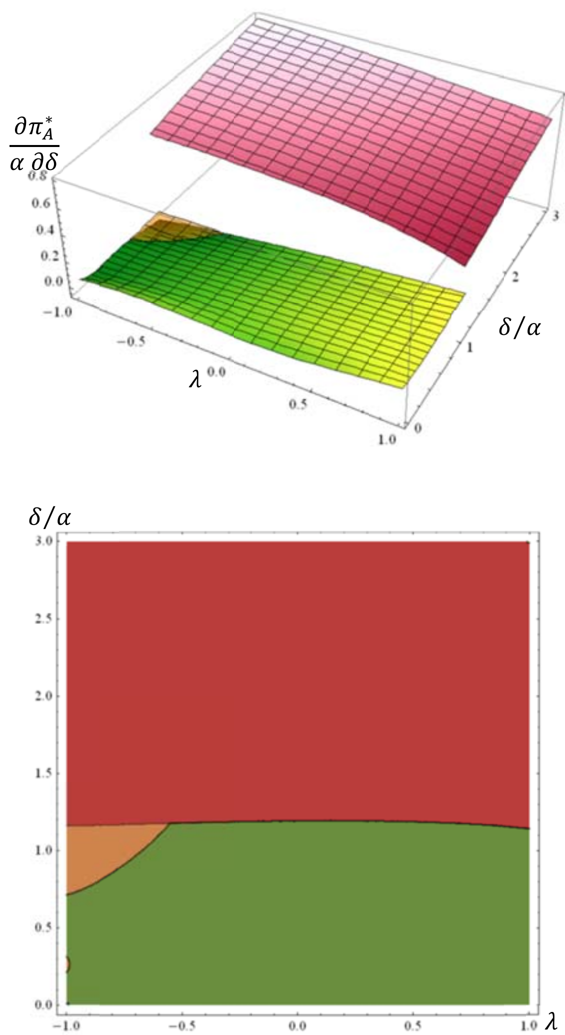


Figure 4a
Firm A's marginal profitability of increasing cost-based synergy, scaled by transport-cost parameter α

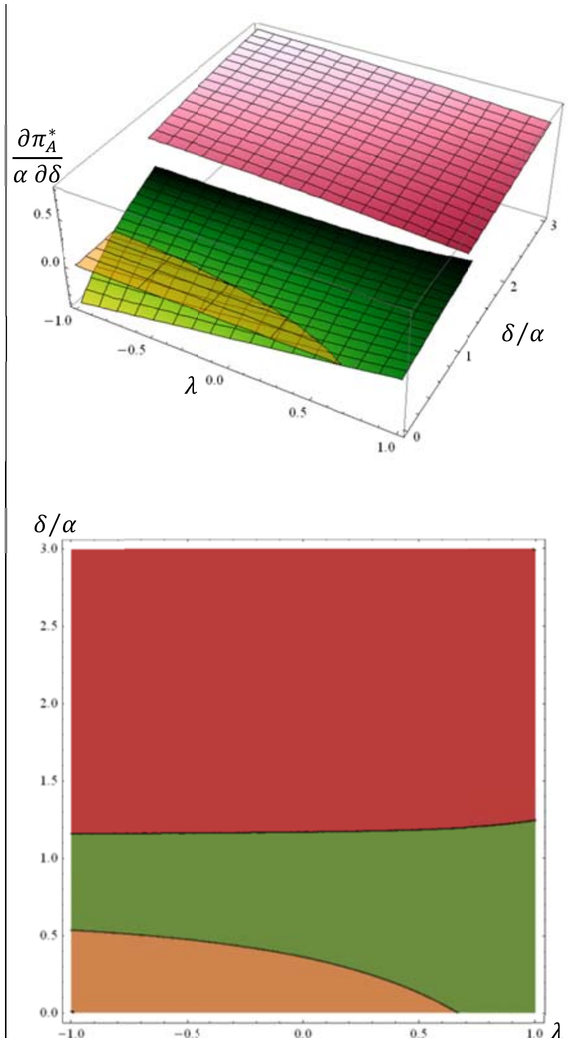


Figure 4b
Firm A's marginal profitability of increasing differentiation-based (WTP) synergy, scaled by transport-cost parameter α

Green area = Competition under pure product strategies (markets separate)
Red area = Competition under pure bundling strategies (markets converged)
"Flooded" Orange area = Negative marginal profitability (backfiring zone)

Figure 4. Scaled marginal profitability of increasing proprietary customer-specific synergies, $(\partial \pi_A^*/\partial \delta)/\alpha$, as a function of cross-market preference correlation parameter, λ, and scaled synergy strength, δ/α.

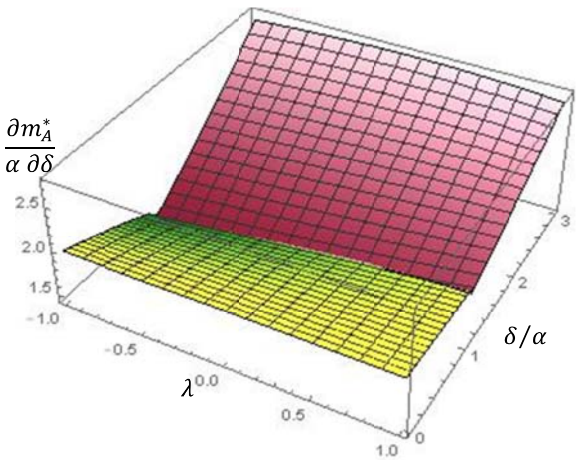


Figure 5a-A
Marginal effect of increasing cost-based synergy on Firm A's margin, scaled by transport-cost parameter α

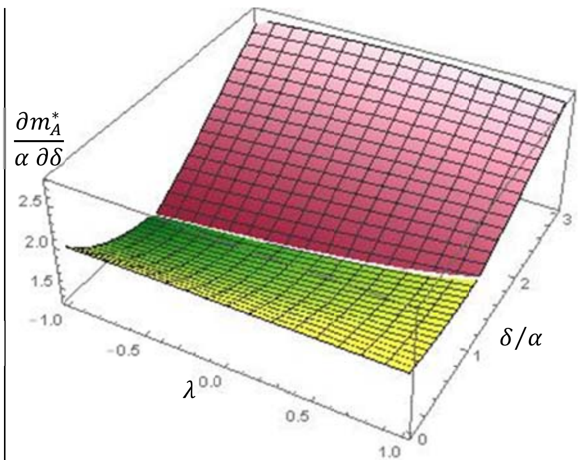


Figure 5b-A
Marginal effect of increasing differentiation-based synergy on Firm A's margin, scaled by transport-cost parameter α

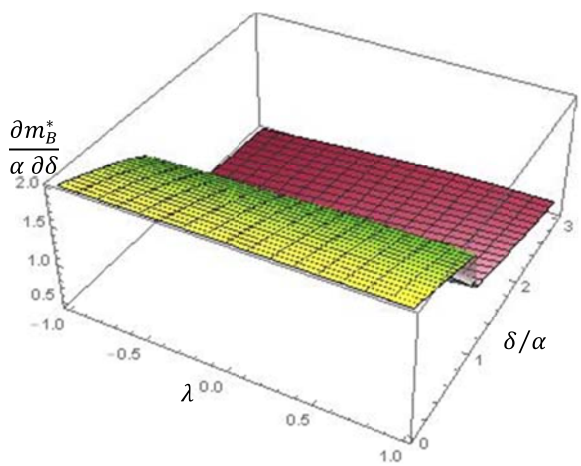


Figure 5a-B
Marginal effect of increasing cost-based synergy on Firm B's margin, scaled by transport-cost parameter α

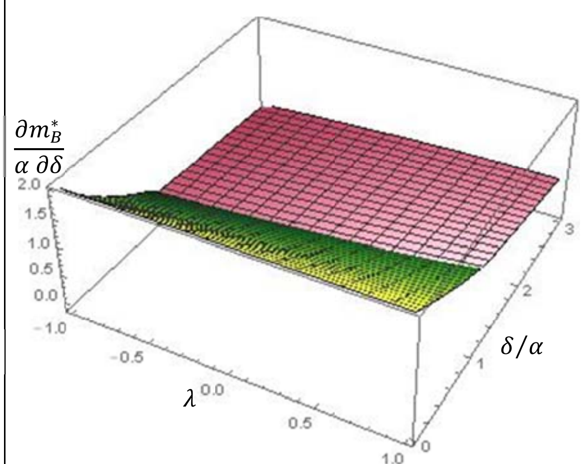


Figure 5b-B
Marginal effect of increasing differentiation-based synergy on Firm B's margin, scaled by transport-cost parameter α

Green area = Competition under pure product strategies (markets separate)
Red area = Competition under pure bundling strategies (markets converged)

Scaled margin is calculated as total, across both products, of price minus cost (adjusted for any cost-based synergies for sales to customers in the AA region), scaled by transport-cost parameter α.

Figure 5. Rivalry effect of increasing proprietary customer-specific synergies on each firm's scaled margin, $(\partial m_i^*/\partial\delta)/\alpha$, as a function of cross-market preference correlation parameter, λ, and scaled synergy strength, δ/α.

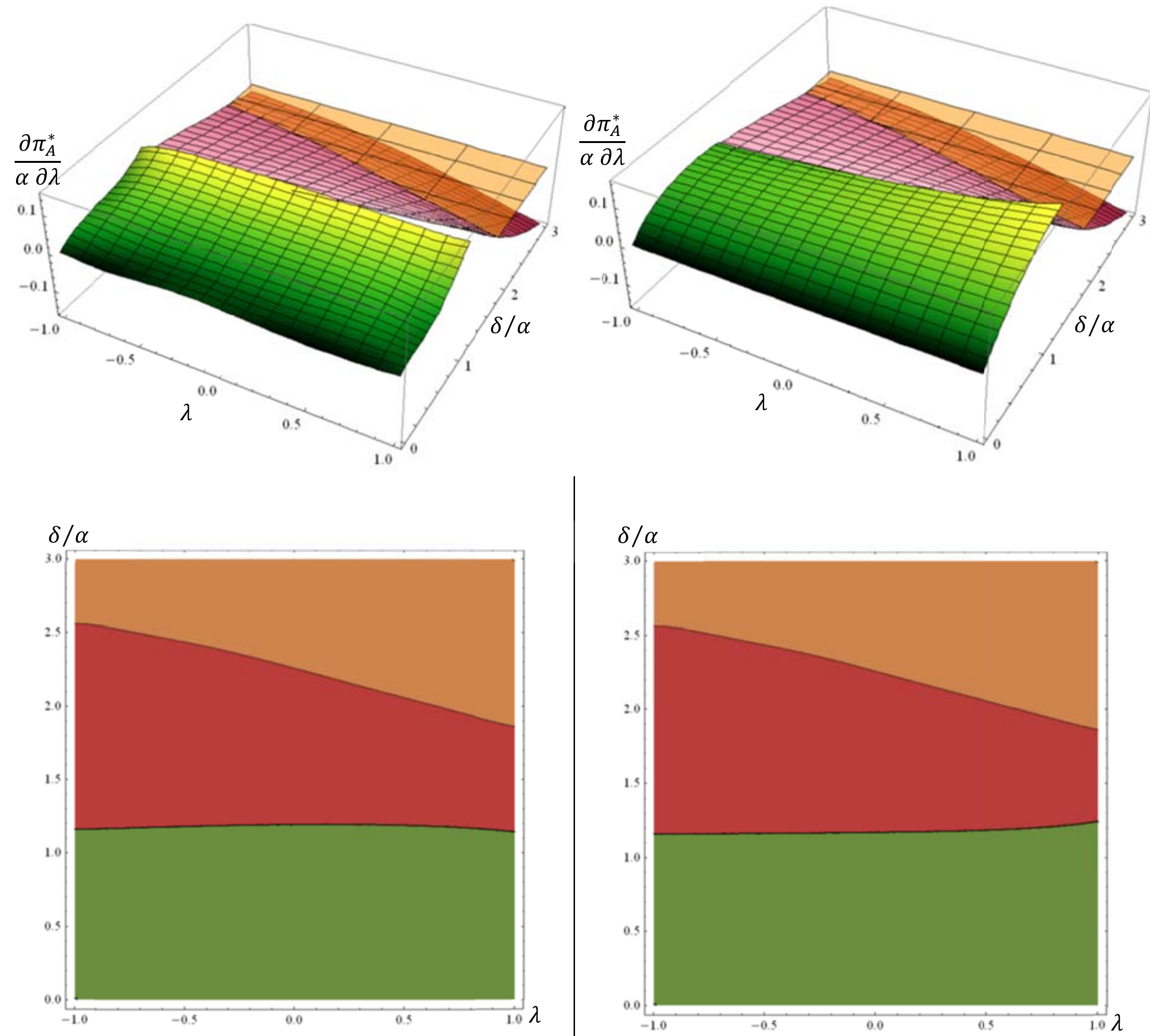


Figure 6a
Firm A's marginal profitability of increasing cross-market preference correlation under a proprietary cost-based synergy, scaled by transport-cost parameter α

Figure 6b
Firm A's marginal profitability of increasing cross-market preference correlation under a proprietary differentiation-based (WTP) synergy, scaled by transport-cost parameter α

Green area = Competition under pure product strategies (markets separate)
Red area = Competition under pure bundling strategies (markets converged)
"Flooded" Orange area = Negative marginal profitability

Figure 6. Scaled marginal profitability of increasing cross-market preference correlation, $(\partial \pi_A^*/\partial \lambda)/\alpha$, under proprietary customer-specific synergies.

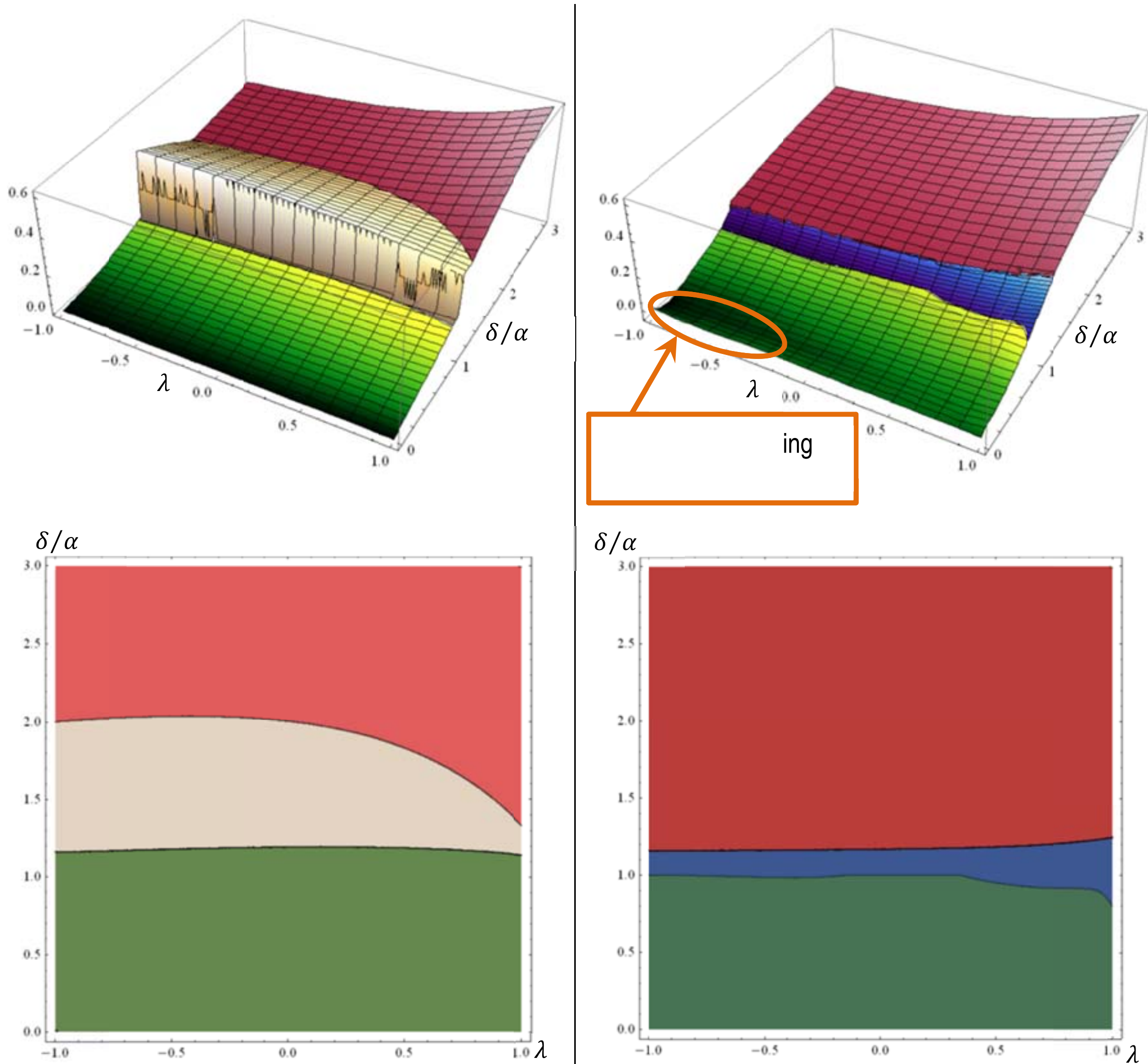


Figure 7a
Firm B's benefit from imitating
cost-based synergy,
scaled by transport-cost parameter α

Figure 7b
Firm B's benefit from imitating
differentiation-based (WTP) synergy,
scaled by transport-cost parameter α

Effects of imitation on firm strategies (market convergence/divergence):
Green area = Pure product strategies (markets separate) both before and after imitation
Red area = Pure bundling strategies (markets converged) both before and after imitation
Blue area = Strategies switch from pure product to pure bundling (market convergence)
Beige area = Strategies switch from pure bundling to pure product (market divergence)

Figure 7. Benefits from imitating customer-specific synergies, as a function of cross-market preference correlation parameter, λ, and scaled synergy strength, δ/α.

Acknowledgements:

The authors gratefully acknowledge the helpful comments of Associate Editor Joe Mahoney, two anonymous referees, David Gaddis Ross, Peter Thompson, Brian Wu, seminar participants at London Business School, HEC Paris, Georgia Institute of Technology, and Southern Methodist University, and reviewers, discussants, and audience members from the Atlanta Competitive Advantage Conference, the CRES Foundations of Strategy Conference, and the Academy of Management. All remaining errors are our own.

REFERENCES

Adner R, Polos L, Ryall M, Sorenson O. 2009. The Case for Formal Theory: Introduction to Special Topic Forum. *Academy of Management Review* **34**(2): 201-208.

Adner R, Zemsky P. 2006. A Demand-Based Perspective on Sustainable Competitive Advantage. *Strategic Management Journal* **27**(3): 215.

Akcura MT, Srinivasan K. 2005. Research Note: Customer Intimacy and Cross-Selling Strategy. *Management Science* **51**(6): 1007-1012.

Benner MJ, Tripsas M. 2012. The Influence of Prior Industry Affiliation on Framing in Nascent Industries: The Evolution of Digital Cameras. *Strategic Management Journal* **33**(3): 277-302.

Brandenburger AM, Stuart HW. 1996. Value-Based Business Strategy. *Journal of Economics & Management Strategy* **5**(1): 5-24.

Brandenburger AM, Stuart HW. 2007. Biform Games. *Management Science* **53**(4): 537.

Cabral LMB, Villas-Boas M. 2005. Bertrand Supertraps. *Management Science* **51**(4): 599-613.

Chatain O. 2011. Value Creation, Competition, and Performance in Buyer-Supplier Relationships. *Strategic Management Journal* **32**(1): 76-102.

Chatain O, Zemsky P. 2007. The Horizontal Scope of the Firm: Organizational Tradeoffs vs. Buyer-Supplier Relationships. *Management Science* **53**(4): 550-565.

Chatain O, Zemsky P. 2011. Value Creation and Value Capture with Frictions. *Strategic Management Journal* **32**(11): 1206-1231.

Christensen CM, Verlinden M, Westerman G. 2002. Disruption, Disintegration and the Dissipation of Differentiability. *Industrial and Corporate Change* **11**(5): 955-993.

Coff RW. 1997. Human Assets and Management Dilemmas: Coping with Hazards on the Road to Resource-Based Theory. *Academy of Management Review* **22**(2): 374-402.

Coff RW. 1999. When Competitive Advantage Doesn't Lead to Performance: The Resource-Based View and Stakeholder Bargaining Power. *Organization Science* **10**(2): 119-133.

Costa LA, Cool K, Dierickx I. 2013. The Competitive Implications of the Deployment of Unique Resources. *Strategic Management Journal* **34**(4): 445-463.

Cottrell T, Nault BR. 2004. Product Variety and Firm Survival in the Microcomputer Software Industry. *Strategic Management Journal* **25**(10): 1005-1025.

D'Aspremont C, Gabszewicz JJ, Thisse J-F. 1979. On Hotelling's "Stability in Competition". *Econometrica* **47**(5): 1145-1150.

Davies A. 2004. Moving Base into High-Value Integrated Solutions: A Value Stream Approach. *Industrial and Corporate Change* **13**(5): 727-756.

Eisenmann T, Parker G, Van Alstyne M. 2011. Platform Envelopment. *Strategic Management Journal* **32**(12): 1270-1285.

Gambardella A, Torrisi S. 1998. Does Technological Convergence Imply Convergence in Markets? Evidence from the Electronics Industry. *Research Policy* **27**(5): 445-463.

Gimeno J, Woo CY. 1999. Multimarket Contact, Economies of Scope, and Firm Performance. *Academy of Management Journal* **42**(3): 239-259.

Grahovac J, Miller DJ. 2009. Competitive Advantage and Performance: The Impact of Value Creation and Costliness of Imitation. *Strategic Management Journal* **30**(11): 1192-1212.

Greenstein S, Khanna T. 1997. What Does Industry Convergence Mean? In *Competing in the Age of Digital Convergence.* Yoffie DB (ed.), Harvard Business School Press: Boston, Mass.

Hinterhuber A. 2002. Value Chain Orchestration in Action and the Case of the Global Agrochemical Industry. *Long Range Planning* **35**(6): 615-635.

Hobday M, Davies A, Prencipe A. 2005. Systems Integration: A Core Capability of the Modern Corporation. *Industrial and Corporate Change* **14**(6): 1109-1143.

Hotelling H. 1929. Stability in Competition. *Economic Journal* **39**(153): 41-57.

Klemperer P, Padilla AJ. 1997. Do Firms' Product Lines Include Too Many Varieties? *RAND Journal of Economics* **28**(3): 472-488.

Lemelin A. 1982. Relatedness in the Patterns of Interindustry Diversification. *Review of Economics and Statistics* **64**: 646-657.

Makadok R, Ross DG. 2013. Taking Industry Structuring Seriously: A Strategic Perspective on Product Differentiation. *Strategic Management Journal* **34**(5): 509-532.

Matutes C, Regibeau P. 1988. 'Mix and Match': Product Compatability without Network Externalities. *RAND Journal of Economics* **19**(2): 221-234.

Matutes C, Regibeau P. 1992. Compatibility and Bundling of Complementary Goods in a Duopoly. *Journal of Industrial Economics* **40**(1): 37-54.

McAlister L. 1982. A Dynamic Attribute Satiation Model of Variety-Seeking Behavior. *Journal of Consumer Research* **9**(2): 141-150.

Morgenstern D. 1956. Einfache Beispiele Zweidimensionaler Verteilungen. *Mitteilungsblatt für Mathematische Statistik* **8**: 234-235.

Nalebuff B. 2004. Bundling as an Entry Barrier. *Quarterly Journal of Economics* **119**(1): 159-187.

Nayyar PR. 1990. Information Asymmetries: A Source of Competitive Advantage for Diversified Service Firms. *Strategic Management Journal* **11**(7): 513-519.

Nayyar PR. 1993. Performance Effects of Information Asymmetry and Economies of Scope in Diversified Service Firms. *Academy of Management Journal* **36**(1): 28-57.

Oliva R, Kallenberg R. 2003. Managing the Transition from Products to Services. *International Journal of Service Industry Management* **14**(2): 160-172.

Pacheco-de-Almeida G, Zemsky P. 2007. The Timing of Resource Development and Sustainable Competitive Advantage. *Management Science* **53**(4): 651-666.

Palich LE, Cardinal LB, Miller CC. 2000. Curvilinearity in the Diversification-Performance Linkage: An Examination of over Three Decades of Research. *Strategic Management Journal* **21**(2): 155-174.

Panzar JC, Willig RD. 1981. Economies of Scope. *American Economic Review* **71**(2): 268-272.

Porter ME. 1980. *Competitive Strategy*. The Free Press: New York.

Porter ME. 1996. What Is Strategy? *Harvard Business Review* **74**(6): 61-78.

Prahalad CK, Hamel G. 1990. The Core Competence of the Corporation. *Harvard Business Review* **68**(3): 79-91.

Priem RL. 2007. A Consumer Perspective on Value Creation. *Academy of Management Review* **32**(1): 219-235.

Priem RL, Li S, Carr JC. 2012. Insights and New Directions from Demand-Side Approaches to Technology Innovation, Entrepreneurship and Strategic Management Research. *Journal of Management* **38**(1): 346-374.

Rumelt RP. 1974. *Strategy, Structure, and Economic Performance*. Harvard Business School Press: Boston.

Schmidt J, Keil T. 2013. What Makes a Resource Valuable? Identifying the Drivers of Firm-Idiosyncratic Resource Value. *Academy of Management Review* **38**(2): 206-228.

Spiller PT, Zelner BA. 1997. Product Complementarities, Capabilities and Governance: A Dynamic Transaction Cost Perspective. *Industrial and Corporate Change* **6**(3): 534-561.

Stieglitz N. 2003. Digital Dynamics and Types of Industry Convergence: The Evolution of the Handheld Computers Market. In *The Industrial Dynamics of the New Digital Economy.* Christensen JF, Maskell P (eds.), Edward Elgar: Cheltenham, UK.

Stremersch S, Tellis GJ. 2002. Strategic Bundling of Products and Prices: A New Synthesis for Marketing. *Journal of Marketing* **66**(1): 55-72.

Tanriverdi H, Lee C-H. 2008. Within-Industry Diversification and Firm Performance in the Presence of Network Externalities: Evidence from the Software Industry. *Academy of Management Journal* **51**(2): 381-397.

Wernerfelt B, Montgomery CA. 1988. Tobin's Q and the Importance of Focus in Firm Performance. *American Economic Review* **78**(1): 246-250.

Williamson OE. 1979. Transaction Cost Economics: The Governance of Contractual Relations. *Journal of Law and Economics* **22**(October): 233-261.

Wirtz BW. 2001. Reconfiguration of Value Chains in Converging Media and Communications Markets. *Long Range Planning* **34**(4): 489-506.

Ye G, Priem RL, Alshwer AA. 2012. Achieving Demand-Side Synergy from Strategic Diversification: How Combining Mundane Assets Can Leverage Consumer Utilities. *Organization Science* **23**: 207-224.

Yoffie DB. 2012. Apple Inc. In 2012. *Harvard Business School Case #5-712-497*.

Zander I, Zander U. 2005. The Inside Track: On the Important (but Neglected) Role of Customers in the Resource-Based View of Strategy and Firm Growth. *Journal of Management Studies* **42**(8): 1519-1548.